

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re PATENT APPLICATION of

Inventor(s): Mills

Group Art Unit: 1754

App'n Ser. No.: 09/009,455

Examiner(s): Tsang for the Secret Committee

Filing Date: 01/20/1998

Title: HYDRIDE FUEL AND EXPLOSIVE



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May 28, 2004

**RESPONSE UNDER RULE 116 TO FINAL OFFICE ACTION**

Commissioner of Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

Applicant files this paper in response to the final Office Action mailed December 3, 2003. Also enclosed is a Petition for a three-month extension together with the appropriate fee.

Reconsideration and allowance of the subject application are respectfully requested.

Claims 1-281 are pending in the application.

Submitted with this Response is new, non-cumulative scientific evidence further demonstrating the existence of lower energy states of hydrogen in many different ways, including, but not limited to, studies of spectroscopic lines, energy output, compositions of matter, generated plasmas, and inverted hydrogen populations. Applicant also identifies the independent third-party data pursuant to the PTO's agreement, which evidence resulted in verbal confirmation of allowability of two copending BlackLight applications handled by Examiner Langel before he was forced to resign from the cases "for moral and ethical reasons," as explained below.

Applicant respectfully demands that the anonymous group of individuals, i.e. "Secret Committee," who is directing the named Examiner's actions in this case, consider and evaluate in detail this and all other evidence of record so far ignored and, to the extent that it finds fault with any of the scientific data, that those findings be communicated to provide Applicant a full and fair opportunity to respond.

The rejection of claims 1-281 under 35 U.S.C. § 101 as being inoperative and lacking utility is respectfully traversed. Applicant respectfully submits that the Secret Committee has not met its burden to provide a *prima facie* case of inoperability for the many reasons of record and, therefore, the rejection should be withdrawn for those reasons alone. Furthermore, Applicant has disclosed substantial experimental evidence in the present disclosure, prior submissions, and submissions herewith that fully rebut any *prima facie* case of inoperability the Committee might have raised. Applicant responds more fully to the Committee's comments, discusses the experimental evidence of record, and summarizes the improper prosecution procedures used by the Committee in the following paragraphs. For these additional reasons, the Section 101 rejection should be withdrawn.

The related rejection of claims 1-281 under 35 U.S.C. § 112, first paragraph, as lacking enablement, is also respectfully traversed. Applicant respectfully submits that the Secret Committee has not met its burden to provide a *prima facie* case of lack of enablement for the many reasons of record and, therefore, the rejection should be withdrawn for those reasons alone. Furthermore, Applicant has disclosed substantial experimental evidence in the present disclosure, prior submissions, and submissions herewith that fully rebut any *prima facie* case of lack of enablement the Examiner might have raised. Applicant responds more fully to the Committee's comments, discusses the experimental evidence of record, and summarizes the improper prosecution procedures used by the Committee in the following paragraphs. For these additional reasons, the Section 112, first paragraph, rejection should be withdrawn.

Applicant also files herewith a Rule 132 Declaration certifying his newly submitted experimental evidence, which further rebuts the Committee's unjustified utility and enablement rejections of the claimed invention. This evidence, which the PTO required Applicant to submit to various scientific journals for publication, conclusively

confirms the formation of lower-energy hydrogen through practice of Applicant's novel hydrogen chemistry. To this day, the Committee has failed to properly consider the numerous Rule 132 Declarations previously filed by Applicant in violation of its own rules as outlined in MPEP § 716:

Evidence traversing rejections must be considered by the examiner whenever present. All entered affidavits, declarations, and other evidence traversing rejections are acknowledged and commented upon by the examiner in the next succeeding action. ... Where the evidence is insufficient to overcome the rejection, the examiner must specifically explain why the evidence is insufficient. General statements such "the declaration lacks technical validity" or "the evidence is not commensurate with the scope of the claims" without an explanation supporting such findings are insufficient. [Emphasis added.]

The Committee does not even mention, let alone consider, any of the certified experimental evidence identified in Applicant's Rule 132 Declarations that were submitted to overcome rejections of record. Consequently, those rejections are fatally defective and should be withdrawn.

With this latest submission, Applicant now has over 100 articles and books of record in this case, as reflected in the "List of References" set forth below.<sup>1</sup> These articles detail studies that experimentally confirm a novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ( $n = 1$ ) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds, including:

extreme ultraviolet (EUV) spectroscopy<sup>2</sup>,  
characteristic emission from catalysis and the hydride ion products<sup>3</sup>,  
lower-energy hydrogen emission<sup>4</sup>,  
plasma formation<sup>5</sup>,  
Balmer  $\alpha$  line broadening<sup>6</sup>,

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<sup>1</sup> While the articles and books numbered 1-70 were already made of record in previous submissions, many of those articles have now been published. Therefore, Applicant submits herewith copies of articles 50-101.

<sup>2</sup> Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98

<sup>3</sup> Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91

<sup>4</sup> Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98

<sup>5</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93

population inversion of hydrogen lines<sup>7</sup>,  
elevated electron temperature<sup>8</sup>,  
anomalous plasma afterglow duration<sup>9</sup>,  
power generation<sup>10</sup>, excessive light emission<sup>11</sup>, and  
analysis of chemical compounds<sup>12</sup>.

Exemplary studies include:

1.) the observation of intense extreme ultraviolet (EUV) emission at low temperatures (e.g.  $\approx 10^3 K$ ) from atomic hydrogen and only those atomized elements or gaseous ions which provide a net enthalpy of reaction of approximately  $m \cdot 27.2 eV$  via the ionization of  $t$  electrons to a continuum energy level where  $t$  and  $m$  are each an integer (e.g.  $K$  and  $Cs$  atoms and  $Rb^+$  and  $Sr^+$  ions ionize at integer multiples of the potential energy of atomic hydrogen and caused emission; whereas, the chemically similar atoms,  $Na$ ,  $Mg$ , and  $Ba$ , do not ionize at integer multiples of the potential energy of atomic hydrogen and caused no emission)<sup>13</sup>,

2.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen with energies of  $q \cdot 13.6 eV$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11, 12$  or these lines inelastically scattered by helium atoms in the excitation of  $He(1s^2)$  to  $He(1s^1 2p^1)$  that were identified as hydrogen transitions to electronic energy levels below the "ground" state corresponding to fractional quantum numbers<sup>14</sup>,

3.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen at 44.2 nm and 40.5 nm with energies of

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<sup>6</sup> Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91,

92, 93, 95-97

<sup>7</sup> Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91

<sup>8</sup> Reference Nos. 34-37, 43, 49, 63, 67, 73

<sup>9</sup> Reference Nos. 12-13, 47, 81

<sup>10</sup> Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98

<sup>11</sup> Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72

<sup>12</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100

<sup>13</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93

<sup>14</sup> Reference Nos. 28, 33-36, 50, 63, 67, 71, 73, 75-76, 78, 86-87, 90, 92, 93



$q \cdot 13.6 + \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \times 13.6 \text{ eV}$  where  $q = 2$  and  $n_f = 2, 4$   $n_i = \infty$  that corresponded to

multipole coupling to give two-photon emission from a continuum excited state atom and an atom undergoing fractional Rydberg state transition<sup>15</sup>,

4.) the identification of transitions of atomic hydrogen to lower energy levels corresponding to lower-energy hydrogen atoms in the extreme ultraviolet emission spectrum from interstellar medium and the sun<sup>16</sup>,

5.) the observation that the novel EUV series of lines with energies of  $q \cdot 13.6 \text{ eV}$  was observed with an Evenson microwave cell, only a the peak corresponding to  $q = 2$  was observed with an RF cell, and none of the peaks were observed with a glow discharge cell<sup>17</sup>,

6.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel EUV series of lines with energies of  $q \cdot 13.6 \text{ eV}$  was only observed for Evenson-cavity helium-hydrogen plasmas<sup>18</sup>,

7.) the EUV spectroscopic observation of lines for a hydrogen-*K* catalyst plasma by the Institut für Niedertemperatur-Plasmaphysik e.V. that could be assigned to transitions of atomic hydrogen to lower energy levels corresponding to fractional principal quantum numbers and the emission from the excitation of the corresponding hydride ions<sup>19</sup>,

8.) the recent analysis of mobility and spectroscopy data of individual electrons in liquid helium which shows direct experimental confirmation that electrons may have fractional principal quantum energy levels<sup>20</sup>,

9.) the observation of novel EUV emission lines from microwave discharges of argon or helium with 10% hydrogen that matched those predicted for the reaction

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<sup>15</sup> Reference Nos. 36, 71, 73

<sup>16</sup> Reference Nos. 1, 5, 17, 28-29

<sup>17</sup> Reference Nos. 71, 73

<sup>18</sup> Reference No. 76

<sup>19</sup> Reference No. 14

<sup>20</sup> eference Nos. 17, 53

$H(1/4) + H^+ \rightarrow H_2(1/4)^+$  having an energy spacing of  $2^2$  times the transition-state vibrational energy of  $H_2^+$  with the series ending on the bond energy of  $H_2(1/4)^+$ <sup>21</sup>,

10.) the result that the novel vibrational series for the reaction  $H(1/4) + H^+ \rightarrow H_2(1/4)^+$  was only observed for catalyst plasmas of helium, neon, and argon mixed with hydrogen, but not with noncatalyst xenon or krypton mixed plasmas<sup>22</sup>,

11.) the observation that based on the intensities of the peaks, the catalyst and the plasma source dependence of the reaction rate to form  $H_2(1/4)^+$  is  $Ar^+ > He^+ > Ne^+$  and microwave > glow discharge >> RF, respectively<sup>23</sup>,

12.) the observation that the microwave plasma source dependence of the reaction rate to form  $H_2(1/4)^+$  is Evenson microwave > McCarroll, cylindrical, Beenakker<sup>24</sup>,

13.) the observation of rotational lines in the 145-300 nm region from atmospheric pressure 15 keV electron-beam excited argon-hydrogen plasmas where the unprecedented energy spacing of  $4^2$  times that of hydrogen established the internuclear distance as 1/4 that of  $H_2$  and identified  $H_2(1/4)$ <sup>25</sup>,

14.) the observation of a series of vibration-rotational bands in the 60-67 nm region, a high-energy region for which vibration-rotational spectra are ordinarily unknown, emitted from low-pressure helium-hydrogen (99/1%) microwave plasmas that matched the predicted energy spacing of the vibrational energy of  $H_2$  about the bond energy of  $H_2(1/2)$  corresponding to the reaction  $2H(1/2) \rightarrow H_2(1/2)$ <sup>26</sup>,

15.) the observation of EUV plasma emission spectra in the region 60 nm to 100 nm that matched the predicted emission lines  $E_{D H_2}$  due to the reaction  $2H(1/2) \rightarrow H_2(1/2)$  with vibronic coupling at energies of  $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$  to longer wavelengths for  $\nu^* = 2$  to  $\nu^* = 32$  and to

<sup>21</sup> Reference Nos. 29, 70, 73, 79, 92, 93, 98

<sup>22</sup> Reference Nos. 29, 70, 73, 79, 92, 93

<sup>23</sup> Reference No. 70

<sup>24</sup> Reference No. 79

<sup>25</sup> Reference No. 98

<sup>26</sup> Reference No. 99

shorter wavelengths for  $\nu^* = 1$  to  $\nu^* = 16$  to within the spectrometer resolution of about  $\pm 0.05\%$ <sup>27</sup>,

16.) the observation that in addition to members of the series of novel emission lines with energies of  $q \cdot 13.6 \text{ eV}$  or  $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$  an additional intense peak was observed from a scaled-up Evenson cell at  $41.6 \text{ nm}$  with an energy of  $29.81 \text{ eV}$  that matched  $q \cdot 13.6 \text{ eV}$  with  $q = 4$  less  $24.58741 \text{ eV}$  corresponding to inelastic scattering of these photons by helium atoms due to ionization of  $\text{He}$  to  $\text{He}^+$ <sup>28</sup>,

17.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel series of spectral lines due to the reaction  $2\text{H}(1/2) \rightarrow \text{H}_2(1/2)$  with vibronic coupling at energies of  $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$  was only observed for Evenson-cavity helium-hydrogen and neon-hydrogen plasmas<sup>29</sup>,

18.) the observation by gas chromatography that hydrogen was consumed by the helium-hydrogen plasmas which showed the novel EUV series of lines with energies of  $q \cdot 13.6 \text{ eV}$ , the novel series of spectral lines due to the reaction  $2\text{H}(1/2) \rightarrow \text{H}_2(1/2)$  with vibronic coupling at energies of  $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$ , extraordinary H Balmer line broadening corresponding to  $180\text{-}210 \text{ eV}$ , and excess power of  $21.9 \text{ W}$  in  $3 \text{ cm}^3$ <sup>30</sup>,

19.) the observation of the dominant  $\text{He}^+$  emission and an intensification of the plasma emission observed when  $\text{He}^+$  was present with atomic hydrogen demonstrated the role of  $\text{He}^+$  as a catalyst<sup>31</sup>,

20.) the observation of continuum state emission of  $\text{Cs}^{2+}$  and  $\text{Ar}^{2+}$  at  $53.3 \text{ nm}$  and  $45.6 \text{ nm}$ , respectively, with the absence of the other corresponding Rydberg series

<sup>27</sup> Reference Nos. 50, 75-76, 78, 86-87, 90, 92, 93

<sup>28</sup> Reference No. 86

<sup>29</sup> Reference No. 76

<sup>30</sup> Reference No. 76

<sup>31</sup> Reference Nos. 36, 73

of lines from these species which confirmed the resonant nonradiative energy transfer of  $27.2\text{ eV}$  from atomic hydrogen to the either  $Cs$  or  $Ar^+$  catalyst<sup>32</sup>,

21.) the spectroscopic observation of the predicted hydride ion  $H^-(1/2)$  of hydrogen catalysis by either  $Cs$  or  $Ar^+$  catalyst at  $407\text{ nm}$  corresponding to its predicted binding energy of  $3.05\text{ eV}$ <sup>33</sup>,

22.) the observation of characteristic emission from  $K^{3+}$  which confirmed the resonant nonradiative energy transfer of  $3 \cdot 27.2\text{ eV}$  from atomic hydrogen to atomic  $K$ <sup>34</sup>,

23.) the spectroscopic observation of the predicted  $H^-(1/4)$  ion of hydrogen catalysis by  $K$  catalyst at  $110\text{ nm}$  corresponding to its predicted binding energy of  $11.2\text{ eV}$ <sup>35</sup>,

24.) the observation of characteristic emission from  $Rb^{2+}$  which confirmed the resonant nonradiative energy transfer of  $27.2\text{ eV}$  from atomic hydrogen to  $Rb^+$ <sup>36</sup>,

25.) the spectroscopic observation of the predicted  $H^-(1/2)$  ion of hydrogen catalysis by  $Rb^+$  catalyst at  $407\text{ nm}$  corresponding to its predicted binding energy of  $3.05\text{ eV}$ <sup>37</sup>,

26.) the observation of  $H^-(1/2)$ , the hydride ion catalyst product of  $K^+ / K^+$  or  $Rb^+$ , at its predicted binding energy of  $3.0468\text{ eV}$  by high resolution visible spectroscopy as a continuum threshold at  $4068.2\text{ Å}$  and a series of structured peaks separated from the binding energy by an integer multiple of the fine structure of  $H(1/2)$  starting at  $4071\text{ Å}$  that matched predicted free-free transitions<sup>38</sup>,

27.) the observation that the high resolution visible  $K^+ / K^+$  or  $Rb^+ - H_2$  plasma emission spectra in the region of  $3995$  to  $4060\text{ Å}$  matched the predicted bound-free

<sup>32</sup> Reference Nos. 24, 39, 51, 54-55, 57, 91

<sup>33</sup> Reference No. 24

<sup>34</sup> Reference Nos. 27, 39, 42, 46, 51, 54-55, 57, 81, 89, 91

<sup>35</sup> Reference Nos. 81, 42, 27

<sup>36</sup> Reference Nos. 32, 39, 42, 46, 51, 54-55, 57, 81, 89, 91

<sup>37</sup> Reference No. 32

<sup>38</sup> Reference Nos. 39, 42, 46, 57, 81, 89, 91

hyperfine structure lines  $E_{HF}$  of  $H^-(1/2)$  calculated from the electron  $g$  factor as  $E_{HF} = j^2 3.00213 \times 10^{-5} + 3.0563 \text{ eV}$  ( $j$  is an integer) for  $j=1$  to  $j=39$  (3.0563 eV to 3.1012 eV—the hydride binding energy peak plus one and five times the spin-pairing energy, respectively) to within a 1 part per  $10^{439}$ ,

28.)  $Rb^+$  or  $2K^+$  catalysts formed a plasma having strong VUV emission with a stationary inverted Lyman population with an overpopulation sufficient for lasing, and emission from  $H^-(1/2)$  was observed at 4071 Å corresponding to its predicted binding energy of 3.0468 eV with the fine structure and its predicted bound-free hyperfine structure lines  $E_{HF} = j^2 3.00213 \times 10^{-5} + 3.0563 \text{ eV}$  ( $j$  is an integer) that matched for  $j=1$  to  $j=37$  to within a 1 part per  $10^{440}$ ,

29.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at wavelengths over a wide range from micron to blue wherein molecular oxygen served as the catalyst as supported by  $O^{2+}$  emission and H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone<sup>41</sup>,

30.) the observation of H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone at distances up to 5 cm from the coupler<sup>42</sup>,

31.) the observation that with a microwave input power of  $9 \text{ W} \cdot \text{cm}^{-3}$ , a collisional radiative model showed that the hydrogen excited state population distribution was consistent with an  $n=1 \rightarrow 5,6$  pumping power of an unprecedented  $200 \text{ W} \cdot \text{cm}^{-3}$  permissive of gas laser efficiencies orders of magnitude those of conventional visible gas lasers and direct generation of electrical power using photovoltaic conversion of the spontaneous or stimulated water vapor plasma emission<sup>43</sup>;

<sup>39</sup> Reference Nos. 39, 42, 46, 57, 81, 89, 91

<sup>40</sup> Reference Nos. 39, 42, 46, 51, 54, 55, 57, 81, 89, 91

<sup>41</sup> Reference Nos. 59, 65-66, 68, 74, 83, 85

<sup>42</sup> Reference No. 74

<sup>43</sup> Reference Nos. 68, 83, 85

32.) the observation of stimulation of the stationary inverted H Balmer population from a low pressure water-vapor microwave discharge plasma by back illumination with an infrared source that showed depopulation of the  $n = 5$  state<sup>44</sup>,

33.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing was observed for Evenson microwave plasmas, but not for RF or discharge plasmas<sup>45</sup>,

34.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the microwave plasma source with the highest inversion from Evenson microwave plasmas<sup>46</sup>,

35.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the pressure of the Evenson microwave plasma<sup>47</sup>,

36.) the observation of stationary inverted H Balmer populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at distances up to 5 cm from the coupler<sup>48</sup>,

37.) the observation that the requirement for the natural hydrogen-oxygen stoichiometry of the Evenson water plasma was stringent in that a deviation by over 2% excess of either gas caused a reversal of the H inversion in water vapor plasmas<sup>49</sup>,

38.) the observation of a typical slow H population for a water-vapor plasma maintained in a GEC-type cell that was independent of time, and a new phenomenon, an extraordinary fast population that increased from zero to a significant portion of the

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<sup>44</sup> Reference Nos. 59, 65, 68, 85

<sup>45</sup> Reference Nos. 59, 65-66, 68, 73, 83, 85

<sup>46</sup> Reference No. 83

<sup>47</sup> Reference Nos. 59, 68, 73, 83, 85

<sup>48</sup> Reference No. 74

<sup>49</sup> Reference Nos. 59, 68, 83, 85

Balmer  $\alpha$  emission with time under no-flow conditions wherein the peak width and energy increased with time up to a 0.7 nm half-width corresponding to an average hydrogen atom energy of 200 eV<sup>50</sup>,

39.) the observation of a substantial fast H population (~20% at 40 eV) for a water-vapor plasmas maintained in a GEC-type cell that was independent of position including regions where the electric field was orders of magnitude too low to explain the extraordinarily high Doppler energies<sup>51</sup>,

40.) the observation of fast H population (40-50 eV) for a  $He/H_2$  (95/5%) as well as  $Ar/H_2$  (95/5%) plasmas maintained in a GEC-type cell that was independent of position including regions where the electric field was orders of magnitude too low to explain the extraordinarily high Doppler energies<sup>52</sup>,

41.) the observation by the Institut für Niedertemperatur-Plasmaphysik e.V. of an anomalous plasma and plasma afterglow duration formed with hydrogen-potassium mixtures<sup>53</sup>,

42.) the observation of anomalous afterglow durations of plasmas formed by catalysts providing a net enthalpy of reaction within thermal energies of  $m \cdot 27.28 \text{ eV}$ <sup>54</sup>,

43.) the formation of a chemically generated hydrogen plasma with the observation of Lyman series in the EUV that represents an energy release about 10 times that of hydrogen combustion which is greater than that of any possible known chemical reaction<sup>55</sup>,

44.) the observation of line emission by the Institut für Niedertemperatur-Plasmaphysik e.V. with a 4° grazing incidence EUV spectrometer that was 100 times more energetic than the combustion of hydrogen<sup>56</sup>,

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<sup>50</sup> Reference No. 95

<sup>51</sup> Reference No. 96

<sup>52</sup> Reference No. 97

<sup>53</sup> Reference Nos. 13, 47, 81

<sup>54</sup> Reference Nos. 12, 13, 47, 81

<sup>55</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91

<sup>56</sup> Reference No. 14

45.) the excessive increase in the Lyman emission upon the addition of helium or argon catalyst to a hydrogen plasma<sup>57</sup>,

46.) the observation of the characteristic emission from  $Sr^+$  and  $Sr^{3+}$  that confirmed the resonant nonradiative energy transfer of  $2 \cdot 27.2 \text{ eV}$  from atomic hydrogen to  $Sr^+$ <sup>58</sup>,

47.) the observation of anomalous plasmas formed with  $Sr$  and  $Ar^+$  catalysts at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source<sup>59</sup>,

48.) the observation that the optically measured output power of gas cells for power supplied to the glow discharge increased by over two orders of magnitude depending on the presence of less than 1% partial pressure of certain catalysts in hydrogen gas or argon-hydrogen gas mixtures, and an excess thermal balance of 42 W was measured for the 97% argon and 3% hydrogen mixture versus argon plasma alone<sup>60</sup>,

49.) the observation that glow discharge plasmas of the catalyst-hydrogen mixtures of strontium-hydrogen, helium-hydrogen, argon-hydrogen, strontium-helium-hydrogen, and strontium-argon-hydrogen showed significant Balmer  $\alpha$  line broadening corresponding to an average hydrogen atom temperature of  $25 - 45 \text{ eV}$ ; whereas, plasmas of the noncatalyst-hydrogen mixtures of pure hydrogen, krypton-hydrogen, xenon-hydrogen, and magnesium-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of  $\approx 3 \text{ eV}$ <sup>61</sup>,

50.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas having catalyst  $Ar^+$  or  $He^+$  showed extraordinary Balmer  $\alpha$  line broadening due to hydrogen catalysis corresponding to an average hydrogen atom temperature of  $110 - 130 \text{ eV}$  and  $180 - 210 \text{ eV}$ , respectively; whereas, plasmas of pure hydrogen, neon-

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<sup>57</sup> Reference Nos. 20, 31, 37, 43

<sup>58</sup> Reference Nos. 16, 52

<sup>59</sup> Reference Nos. 11, 16, 20, 23, 52, 72

<sup>60</sup> Reference No. 22

<sup>61</sup> Reference Nos. 16, 20, 30, 52, 72



hydrogen, krypton-hydrogen, and xenon-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of  $\approx 3 \text{ eV}$ <sup>62</sup>,

51.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas showed average electron temperatures that were high,  $30,500 \pm 5\% \text{ K}$  and  $13,700 \pm 5\% \text{ K}$ , respectively; whereas, the corresponding temperatures of helium and argon alone were only  $7400 \pm 5\% \text{ K}$  and  $5700 \pm 5\% \text{ K}$ , respectively<sup>63</sup>,

52.) the observation of significant Balmer  $\alpha$  line broadening of 17, 9, 11, 14, and 24 eV from rt-plasmas of incandescently heated hydrogen with  $K^+ / K^+$ ,  $Rb^+$ , cesium, strontium, and strontium with  $Ar^+$  catalysts, respectively, wherein the results could not be explained by Stark or thermal broadening or electric field acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV<sup>64</sup>,

53.) calorimetric measurement of excess power of 20 mW/cc on rt-plasmas formed by heating hydrogen with  $K^+ / K^+$  and  $Ar^+$  as catalysts<sup>65</sup>,

54.) the observation of rt-plasmas formed with strontium and argon at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source as well as an excess power of 20 mW/cm from rt-plasmas formed by  $Ar^+$  as the catalyst in an incandescent-filament cell<sup>66</sup>,

55.) the Calvet calorimetry measurement of an energy balance of over  $-151,000 \text{ kJ/mole } H_2$  with the addition of 3% hydrogen to a plasma of argon having the catalyst  $Ar^+$  compared to the enthalpy of combustion of hydrogen of  $-241.8 \text{ kJ/mole } H_2$ ; whereas, under identical conditions no change in the Calvet voltage was observed when hydrogen was added to a plasma of noncatalyst xenon<sup>67</sup>,

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<sup>62</sup> Reference Nos. 33-37, 43, 49, 60, 63-64, 69, 71, 73-74, 82, 84, 88, 92, 93

<sup>63</sup> Reference Nos. 34-37, 43, 49, 63, 67, 73

<sup>64</sup> Reference Nos. 39, 42, 46, 51-52, 54-55, 57, 72, 81, 89, 91

<sup>65</sup> Reference Nos. 39, 81, 89

<sup>66</sup> Reference No. 72

<sup>67</sup> Reference No. 31

56.) the observation that the power output exceeded the power supplied to hydrogen glow discharge plasmas by 35-184 W depending on the presence of catalysts from helium or argon and less than 1% partial pressure of strontium metal in noble gas-hydrogen mixtures; whereas, the chemically similar noncatalyst krypton had no effect on the power balance<sup>68</sup>,

57.) the observation that with the addition of 3% flowing hydrogen to an argon microwave plasma with a constant input power of 40 W, the gas temperature increased from 400°C to over 750°C; whereas, the 400°C temperature of a xenon plasma run under identical conditions was essentially unchanged with the addition of hydrogen<sup>69</sup>,

58.) observations of power such as that where the addition of 10% hydrogen to a helium microwave plasma maintained with a constant microwave input power of 40 W, the thermal output power was measured to be at least 280 W corresponding to a reactor temperature rise from room temperature to 1200°C within 150 seconds, a power density of  $28 \text{ MW}/\text{m}^3$ , and an energy balance of at least  $-4 \times 10^5 \text{ kJ}/\text{mole } H_2$  compared to the enthalpy of combustion of hydrogen of  $-241.8 \text{ kJ}/\text{mole } H_2$ <sup>70</sup>,

59.) the observation of  $306 \pm 5 \text{ W}$  of excess power generated in  $45 \text{ cm}^3$  by a compound-hollow-cathode-glow discharge of a neon-hydrogen (99.5/0.5%) mixture corresponding to a power density of  $6.8 \text{ MW}/\text{m}^3$  and an energy balance of at least  $-1 \times 10^6 \text{ kJ}/\text{mole } H_2$  compared to the enthalpy of combustion of hydrogen of  $-241.8 \text{ kJ}/\text{mole } H_2$ <sup>71</sup>,

60.) the observation that for an input of 37.7 W, the total plasma power of the neon-hydrogen plasma measured by water bath calorimetry was 60.7 W corresponding to 23.0 W of excess power in  $3 \text{ cm}^3$ <sup>72</sup>,

61.) the observation of intense  $He^+$  emission and a total plasma power of a helium-hydrogen plasma measured by water bath calorimetry of 30.0 W for an input of 8.1 W, corresponding to 21.9 W of excess power in  $3 \text{ cm}^3$  wherein the excess power

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<sup>68</sup> Reference No. 30

<sup>69</sup> Reference No. 43

<sup>70</sup> Reference Nos. 34, 35

<sup>71</sup> Reference Nos. 50, 78

<sup>72</sup> Reference No. 76

density and energy balance were high,  $7.3 \text{ W/cm}^3$  and  $-2.9 \times 10^4 \text{ kJ/mole H}_2$ , respectively<sup>73</sup>,

62.) in the comparison of helium-hydrogen plasmas sources, the observation that i.) with an input power of  $24.8 \pm 1 \text{ W}$ , the total plasma power of the Evenson microwave helium-hydrogen plasma measured by water bath calorimetry was  $49.1 \pm 1 \text{ W}$  corresponding to  $24.3 \pm 1 \text{ W}$  of excess power in  $3 \text{ cm}^3$  corresponding to a high excess power density and energy balance of  $8.1 \text{ W/cm}^3$  and over  $-3 \times 10^4 \text{ kJ/mole H}_2$ , respectively, ii.) with an input of  $500 \text{ W}$ , a total power of  $623 \text{ W}$  was generated in a  $45 \text{ cm}^3$  compound-hollow-cathode-glow discharge, iii.) less than 10% excess power was observed from inductively coupled RF helium-hydrogen plasmas, and iv.) no measurable heat was observed from MKS/Astex microwave helium-hydrogen plasmas that corresponded to the absence of H Balmer line broadening<sup>74</sup>,

63.) the observation of energy balances of helium-hydrogen microwave plasmas of over 100 times the combustion of hydrogen and power densities greater than  $10 \text{ W/cm}^3$  measured by water bath calorimetry<sup>75</sup>,

64.) at the load matching condition of  $600 \Omega$ , the direct plasmadynamic conversion (PDC) of open circuit voltages of  $11.5 \text{ V}$  and  $\sim 200 \text{ mW}$  of electrical power with a  $0.125$  in diameter by  $3/4$  in long plasmadynamic electrode and a  $140 \text{ G}$  applied field corresponding to an extracted power density of  $\sim 1.61 \text{ W/cm}^3$  and an efficiency of  $\sim 18.8\%$ <sup>76</sup>,

65.) at the load matching condition of  $250 \Omega$ , the direct plasmadynamic conversion (PDC) of open circuit voltages of  $21.8 \text{ V}$  and  $1.87 \text{ W}$  of electrical power with a  $0.125$  in diameter by  $3/4$  in long plasmadynamic electrode and a  $140 \text{ G}$  applied field corresponding to an extracted power density of  $3.6 \text{ W/cm}^3$  and an efficiency of  $42\%$ <sup>77</sup>,

66.) the projection that the generation of electricity using magnetohydrodynamic (MHD) conversion of the plasma particle energy of small to mid-size chemically assisted

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<sup>73</sup> Reference Nos. 36, 63, 71, 73

<sup>74</sup> Reference Nos. 84, 98

<sup>75</sup> Reference Nos. 34-36, 50, 63, 71, 73, 76-78, 84

<sup>76</sup> Reference No. 48

<sup>77</sup> Reference No. 56

microwave or glow discharge plasma (ca-plasma) power sources in the range of a few hundred Watts to several 10's of kW for microdistributed commercial applications appears feasible at 50% efficiency or better with a simple compact design<sup>78</sup>,

67.) the differential scanning calorimetry (DSC) measurement of minimum heats of formation of  $KHI$  by the catalytic reaction of  $K$  with atomic hydrogen and  $KI$  that were over  $-2000 \text{ kJ/mole } H_2$  compared to the enthalpy of combustion of hydrogen of  $-241.8 \text{ kJ/mole } H_2$ <sup>79</sup>,

68.) the isolation of novel hydrogen compounds as products of the reaction of atomic hydrogen with atoms and ions which formed an anomalous plasma as reported in the EUV studies<sup>80</sup>,

69.) the synthesis and identification of a novel diamond-like carbon film terminated with  $CH(1/p)$  ( $H^* DLC$ ) comprising high binding energy hydride ions was synthesized for the first time from solid carbon by a microwave plasma reaction of a mixture of 10-30% hydrogen and 90-70% helium wherein  $He^+$  served as a catalyst with atomic hydrogen to form the highly stable hydride ions and an energetic plasma<sup>81</sup>,

70.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of helium-hydrogen-methane (48.2/48.2/3.6%) wherein  $He^+$  served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of 180 - 210 eV versus  $\approx 3 \text{ eV}$  for pure hydrogen and bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond<sup>82</sup>,

71.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%) wherein  $Ar^+$  served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of

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<sup>78</sup> Reference No. 40

<sup>79</sup> Reference No. 25

<sup>80</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 75, 81, 87, 90, 92, 93, 100

<sup>81</sup> Reference No. 60

<sup>82</sup> Reference Nos. 64, 69, 88

110 - 130 eV versus  $\approx 3$  eV for pure hydrogen and bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond<sup>83</sup>,

72.) the identification of a novel highly stable surface coating  $SiH(1/p)$  by time of flight secondary ion mass spectroscopy that showed  $SiH^+$  in the positive spectrum and  $H^-$  dominant in the negative spectrum and by X-ray photoelectron spectroscopy which showed that the  $H$  content of the  $SiH$  coatings was hydride ions,  $H^-(1/4)$ ,  $H^-(1/9)$ , and  $H^-(1/11)$  corresponding to peaks at 11, 43, and 55 eV, respectively, and showed that the surface was remarkably stable to air<sup>84</sup>,

73.) the isolation of novel inorganic hydride compounds such as  $KHKHCO_3$  and  $KH$  following each of the electrolysis and plasma electrolysis of a  $K_2CO_3$  electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on  $KHKHCO_3$  which showed inorganic hydride clusters  $K[KHKHCO_3]^+$  and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii)  $^1H$  nuclear magnetic resonance spectroscopy which showed upfield shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions<sup>85</sup>,

74.) the identification of  $LiHCl$  comprising a high binding energy hydride ion by time of flight secondary ion mass spectroscopy which showed a dominant  $H^-$  in the negative ion spectrum, X-ray photoelectron spectroscopy which showed  $H^-(1/4)$  as a new peak at its predicted binding energy of 11 eV,  $^1H$  nuclear magnetic resonance spectroscopy which showed an extraordinary upfield shifted peak of -15.4 ppm corresponding to the novel hydride ion, and powder X-ray diffraction which showed novel peaks<sup>86</sup>,

75.) the identification of novel hydride compounds by a number of analytical methods such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy

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<sup>83</sup> Reference Nos. 82, 88

<sup>84</sup> Reference Nos. 45, 61, 100

<sup>85</sup> Reference Nos. 6-7, 9, 38, 41

<sup>86</sup> Reference Nos. 44, 62

which showed novel hydride peaks and significant shifts of the core levels of the primary elements bound to the novel hydride ions, (iii)  $^1\text{H}$  nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and (iv) thermal decomposition with analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides<sup>87</sup>,

76.) the NMR identification of novel hydride compounds  $MH^*X$  wherein  $M$  is the alkali or alkaline earth metal,  $X$ , is a halide, and  $H^*$  comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance<sup>88</sup>,

77.) the replication of the NMR results of the identification of novel hydride compounds by large distinct upfield resonances at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada<sup>89</sup>,

78.) the NMR identification of novel hydride compounds  $MH^*$  and  $MH_2^*$  wherein  $M$  is the alkali or alkaline earth metal and  $H^*$  comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition<sup>90</sup>,

79.) the observation that the  $^1\text{H}$  MAS NMR spectrum of novel compound  $KH^*Cl$  relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of  $p = 4$ , and the novel peak of  $KH^*I$  at -1.5 ppm relative to TMS corresponding to an absolute resonance shift of -33.0 ppm matched the theoretical prediction of  $p = 2$ <sup>91</sup>,

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<sup>87</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 75, 81, 87, 90, 92, 93, 100

<sup>88</sup> Reference Nos. 10, 19, 41, 44, 62, 81

<sup>89</sup> Reference Nos. 19, 81

<sup>90</sup> Reference Nos. 19, 81

<sup>91</sup> Reference No. 81

80.) the observation that the predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for  $H^-(1/2)$  and  $H^-(1/4)$  were found to be in agreement<sup>92</sup>,

81.) the isolation of fraction-principal-quantum-level molecular hydrogen  $H_2(1/p)$  gas by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap, and the observations of novel peaks by cryogenic gas chromatography, a higher ionization energy than  $H_2$  by mass spectroscopy, a unique EUV emission spectrum by optical emission spectroscopy that shifted with deuterium substitution in a region where no hydrogen emission has ever been observed that unequivocally confirmed the existence of lower-energy molecular hydrogen, and upfield shifted NMR peaks at 0.21, 2.18 and 3.47 ppm compared to that of  $H_2$  at 4.63 ppm<sup>93</sup>,

82.) the observation of singlet peaks upfield of  $H_2$  with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm identified as the consecutive series  $H_2(1/2)$ ,  $H_2(1/3)$ ,  $H_2(1/4)$ ,  $H_2(1/5)$ ,  $H_2(1/6)$ , and  $H_2(1/7)$ , respectively, and  $H_2(1/10)$  at -1.8 ppm wherein  $H_2(1/p)$  gas was isolated by liquefaction at liquid nitrogen temperature and by decomposition of compounds found to contain the corresponding hydride ions  $H^-(1/p)$ <sup>94</sup>.

Applicant again respectfully demands that the Secret Committee consider and evaluate in detail all of this record evidence, which, to date, it has largely ignored. The scientific data disclosed in this extensive body of evidence was collected and peer-reviewed with great care by a group of highly qualified scientists capable of understanding every detail of Applicant's technology. The very least the Committee can do is to also carefully evaluate that data in detail, article by article, with an open mind, so that Applicant is given a full and fair opportunity to present his case. If and when the Committee finally does so, Applicant believes it will find that the evidence overwhelmingly proves the existence of lower-energy hydrogen in accordance with his claimed invention.

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<sup>92</sup> Reference No. 81

<sup>93</sup> Reference Nos. 75, 87, 90, 92, 93, 94

<sup>94</sup> Reference No. 98

If, on the other hand, the Committee should find true fault with any of that data on legitimate scientific grounds—not the kind of nitpicking Applicant has seen on theoretical grounds—it should communicate as much to afford Applicant the opportunity to respond. Such scientific give-and-take is the only way to advance the prosecution of this case.

Unfortunately, with continued prosecution of this and BlackLight's other applications, a far different pattern has emerged. The Secret Committee continues to set arbitrary and capricious hurdles designed to avoid considering Applicant's conclusive experimental evidence and thereby block his patents from issuing. Each time Applicant clears one of these hurdles, the Committee merely raises the bar.

For instance, the Committee initially alleged that Applicant's disclosed hydrogen chemistry, which forms lower-energy hydrogen, related to the controversial concepts of "perpetual motion" and "cold fusion." When Applicant exposed those allegations as utter nonsense, the Committee quickly abandoned its indefensible position, arguing instead that BlackLight's lower-energy hydrogen technology violated unidentified laws of physics. Then, to cover up its failure to identify even a single physical law that was supposedly being violated, the Committee improperly placed the burden on Applicant to do so: "in order to establish enablement, applicant bears the burden of providing the accepted scientific laws wrong or incomplete." When Applicant showed just the opposite is true—that Applicant's novel hydrogen chemistry complies with all physical laws, even at atomic and sub-atomic levels—the Committee once again backpedaled and changed its position. The Committee then advanced vague assertions that Applicant's lower-energy hydrogen violated "ideas" of modern science and, later, that his technology contradicted "beliefs" in the scientific community.

The only consistency found throughout these myriad of absurd positions is the Secret Committee's use of each to excuse it from fairly considering and evaluating Applicant's scientific evidence that lower-energy hydrogen does indeed exist. Instead, the Committee prefers engaging in a theoretical debate to the exclusion of that evidence, pitting its favored quantum theory, with all of its far-fetched and disproved predictions, against Applicant's theory of classical quantum mechanics that correctly predicts the formation of lower-energy hydrogen.



Applicant has willingly engaged the Committee in this debate, and will continue to do so if necessary, even though the patent laws do not require that an inventor understand the precise theoretical basis for why his invention works. All the law requires is that he disclose his invention in sufficient detail to enable one of ordinary skill in the art how to practice it. Applicant has done precisely that and the Committee has failed in its burden to show otherwise.

Of course, the debate over these competing theories can go on indefinitely without resolution, which may be the Committee's strategy. Engaging in that intellectual exercise, however, will not—indeed cannot—definitively settle the question of whether practicing Applicant's disclosed hydrogen chemistry results in the formation of lower-energy hydrogen. Like any good theoretical debate, this one can only be tested and ultimately settled by fairly analyzing the unprecedented amount of experimental evidence Applicant has submitted conclusively confirming the lower energy states of hydrogen.

Applicant has expended tens of millions of dollars amassing this experimental evidence. The least the Secret Committee can do is properly consider it. The Committee's view, however, appears to be that, because the existence of lower-energy hydrogen is theoretically impossible—at least according to its misguided view of quantum mechanics—it need not seriously analyze any contrary evidence. Applicant is hard pressed to imagine an approach to patent examination any more arbitrary and capricious than that.

In the few isolated instances in which the Secret Committee does address Applicant's evidence, it comes up with ridiculous reasons for dismissing it without a fair hearing, again demonstrating its arbitrary and capricious approach. One prominent example occurred during the February 21, 2001 Interview of this and other BlackLight applications, which was led by Examiner Vasudevan Jagannathan—one of the few Committee members Applicant has been able to successfully identify. At that interview, Applicant had a brief opportunity to present some of his scientific evidence, including spectroscopic data that is extraordinarily reliable in analyzing chemical compositions. Such data amounts to a "chemical fingerprint" that cannot be seriously disputed.

Despite the conclusiveness of that evidence, Examiner Jagannathan dismissed it out of hand as nothing more than “a bunch of squiggly lines.”

To put the absurdity of that comment in context, the PTO rationalized its withdrawal of BlackLight’s allowed patent applications, in part, by citing a January 12, 2000 article written by Dr. Robert Park, spokesman for one of Applicant’s main competitors, the American Physical Society (APS). [March 22, 2000 Decision at page 7 (Attachment G)] In that article, Dr. Park made the following startling statement:

The energy states of atoms are studied through their atomic spectra—light emitted at very specific wavelengths when electrons make a jump from one energy level to another. The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line.

There is no line corresponding to a “hydrino” state. Indeed there is no credible evidence at all to support Mills’ claim. [See Attachment J]

The incredible irony here—one that cannot be easily overlooked—highlights once again the extreme arbitrary and capricious approach the Secret Committee has taken in examining this and other BlackLight applications. There is no question that the vitriol espoused by Dr. Park in his cited *Post* article was, at least, partially responsible for the PTO’s suspect withdrawal of five allowed BlackLight applications from issue. And yet, despite the fact that the very article the PTO relies upon to deny Applicant his patents recognizes that spectroscopic data is extraordinarily reliable—indeed, the “platform on which our entire understanding of atomic physics is built”—the Committee nonetheless continues to cavalierly ignore or dismiss that same data when submitted by Applicant.

Out of exasperation, Applicant queried Examiner Jagannathan during the February 21 Interview as to what type and quality of evidence would convince him that lower-energy hydrogen exists. The Examiner required that Applicant publish his experimental evidence in peer-reviewed scientific journals for that evidence to be considered reliable. As detailed above, Applicant has more than met this newly created “publication” standard for considering experimental evidence by submitting over 100 scientific papers for publication. So far, over 50 of these papers have completed and passed the peer-review process conducted by highly qualified Ph.D. referees.

The esteemed list of journals to which Applicant's experimental evidence has been submitted includes:

Applied Physics Letters;  
Chemistry of Materials;  
Electrochimica Acta;  
Europhysics Letters;  
European Journal of Physics;  
European Physics Journal B;  
Fuels and Energy;  
IEEE Transactions on Plasma Science;  
International Journal of Hydrogen Energy;  
Journal of Applied Physics;  
Journal of Hydrogen Energy;  
Journal of Molecular Structure;  
Journal of New Materials for Electrochemical Systems;  
Journal of Physics D, Applied Physics;  
Journal of Physical Chemistry A;  
Journal of Plasma Physics;  
Journal of Quantitative Spectroscopy and Radiative Transfer;  
Journal Vacuum Science and Technology;  
Materials Characterization;  
New Journal of Physics;  
Optical Materials;  
Physics Essays;  
Physica B;  
Plasma Sources Science and Technology;  
Solar Energy Materials & Solar Cells;  
Thermochimica Acta;  
Thin Solid Films;  
Vacuum; and  
Vibrational Spectroscopy.

Once again, however, the Secret Committee has raised the bar to patentability by arbitrarily and capriciously ignoring this vast body of evidence, apparently believing that its anonymous Committee members are better qualified than the numerous skilled PhD's who peer-reviewed and approved Applicant's articles confirming the existence of lower-energy hydrogen.

The PTO's mishandling of the experimental evidence of record in this case is but one of several improper actions that have adversely effected Applicant's patent rights.

Others include:

- (1) illegally withdrawing or threatening to withdraw other copending BlackLight patent applications from issue, after initially allowing all claims, under highly suspicious circumstances that suggest possible interference by BlackLight's competitors;
- (2) improperly examining this application by Secret Committee, effectively denying Applicant the right to confront the persons involved in that examination and access their qualifications, and to ascertain whether those persons include BlackLight's competitors, or other improper outside influences, in breach of PTO confidentiality requirements; and
- (3) refusing reasonable requests by Applicant and five U.S. Senators to divulge information relating to the events that triggered the PTO's withdrawal action, and the identity of all PTO employees and non-PTO personnel involved in examining BlackLight's applications.

These improper actions bear directly upon the prosecution of BlackLight's pending applications, yet Applicant's good faith efforts to discuss and resolve these and other outstanding issues have been either ignored or rejected out of hand. Applicant's latest overture was communicated directly to then PTO Director James E. Rogan in a letter dated December 21, 2001, from BlackLight board member Dr. Shelby T. Brewer. Dr. Brewer received his Ph.D. in Nuclear Engineering from M.I.T. and served as Assistant Energy Secretary in the Reagan administration. [See Attachment A]

As stated in his letter, Dr. Brewer's reasons for appealing to Director Rogan were motivated not only by his fiduciary duty to protect BlackLight's best interests, but also by a sincere desire to avoid unnecessary embarrassment to the PTO over these lingering issues if left unresolved. Dr. Brewer appealed for a meeting with Director Rogan in an

attempt to bring some closure to this matter in a way that might mutually benefit both sides.

Despite the urgency of his plea, Dr. Brewer waited over four months before finally receiving a response to his request for a meeting. In a curt letter dated April 24, 2002, from the Director's Chief-of-Staff, Jason C. Roe, the PTO advised: "We appreciate your interest in this matter, but, unfortunately, must decline your request for a meeting due to the fact that the USPTO is not in a position to discuss the issue at the present time."

[See Attachment A]

This negative response, while disappointing, was hardly surprising. In refusing to meet with Applicant, the PTO continues to treat prosecution of this and BlackLight's other copending cases as an adversarial proceeding. While the PTO may believe it is justified in shrouding its untoward actions under a cloak of secrecy and remaining answerable to no one, that approach does little to preserve public confidence in the patent process. Only by openly engaging Applicant in mutually beneficial discussions of all the issues in this case can the PTO ever hope to achieve that worthy goal. Applicant therefore implored Director Rogan to reconsider his decision and adopt a more flexible and cooperative approach by agreeing to meet with Applicant to discuss the handling of this and other pending BlackLight applications before taking any further action.

Perhaps the PTO sees no need to modify its approach, buoyed by the Federal Circuit's June 28, 2002 Decision upholding its withdrawal action that cancelled issuance of BlackLight's allowed patent applications. See *BlackLight Power, Inc. v. Director James E. Rogan*, 63 USPQ2d1534 (Fed. Cir. June 28, 2002) [See Attachment B]. The Federal Circuit ruled, among other things, that an "emergency situation" trumped the controlling regulation requiring the PTO to determine the unpatentability of one or more claims before it withdrew the '294 application from issue so that the PTO's mere "concern" over patentability provided adequate basis for the withdrawal. That Decision, aside from the fact that it is erroneous,<sup>95</sup> does not even begin to resolve other issues that touch on the merits of this case.

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<sup>95</sup> Applicant believes that the Federal Court's opinion is erroneous due, in part, to its misreading of a concurring opinion of one Justice in a 38-year-old Supreme Court case to support its holding that this supposed "emergency situation"—a finding that was not supported by the record or even argued by the

One such issue is how this alleged “emergency situation” arose in the first place, *i.e.*, how the PTO became aware of BlackLight’s issued U.S. Patent No. 6,024,935 (the ‘935 patent) that supposedly raised “concerns” about other pending applications. That issue apparently was not important to Associate Solicitor Kevin Baer who defended the PTO’s conduct by arguing to the District Court: “I would even say, Your Honor, you could imagine in our head any scenario of how we learned about it. A blimp flying over us. It doesn’t matter, because what matters, Your Honor, is the decision [to withdraw] itself.” [May 22, 2000 Transcript at 22 (Attachment K, Tab E)]

Judge Sullivan, however, was apparently unimpressed by those comments, noting in footnote 10 of his opinion that he was “troubled by several steps in the PTO’s process” and advising the PTO to “examine its patent issuance process so that their normal operations are not compromised by such seemingly suspicious procedures.” [See 109 F.Supp. 2d at 53 (See Attachment L)]

While the PTO may be unconcerned how it learned of the ‘935 patent, Applicant considers that information critically important. If, for instance, competitors were somehow involved in events leading to the withdrawal of BlackLight’s allowed applications and, perhaps, in the subsequent prosecution of those and other applications, that information would relate directly to the credibility of the rejections

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PTO—justified the PTO’s withdrawing BlackLight’s copending ‘294 application from issue on February 17, 2000, after payment of the issue fee. See *BlackLight Power* at page 7 citing *Baltimore & Ohio Railroad Co. v. United States*, 386 U.S. 372, 421 (1964) (Brennan, J., concurring) (recognizing the importance of leaving the Interstate Commerce Commission (ICC) great flexibility to deal with emergency situations to avoid serious damage to the national transportation system, but finding no pressing need that justified the ICC’s action). The Federal Circuit stretched that case way beyond the limits of Supreme Court precedent that requires government agencies to strictly follow statutory and regulatory guidelines.

Incredibly, at oral argument, the PTO did not even suggest that an emergency situation had forced it to withdraw this application from issue on February 17, 2000. To the contrary, PTO Solicitor John M. Whealan argued that no withdrawal—emergency or otherwise—occurred on that date and admitted that, if the Court found otherwise, his case would be seriously compromised. This was because, at that time, the PTO could not locate the patent file and admittedly could not have made a determination of unpatentability of one or more claims as required by the controlling regulation. See 37 C.F.R. § 1.131(b)(3); MPEP § 1308 (7<sup>th</sup> Ed., Rev. 1, Feb. 2000). To avoid an adverse ruling, Solicitor Whealan sought refuge outside the administrative record, suggesting for the first time that the PTO had used the wrong form in mistakenly notifying Applicant on February 17 that his application had been withdrawn. Then, again without evidentiary support, the Solicitor tried to convince a skeptical Court that Director Kepplinger, in consultation with the Examiner, had made an unpatentability determination sometime later, after Applicant had voluntarily supplied the PTO with a copy of the application—hardly an emergency situation if it were true.

entered in those cases, including this one. Applicant therefore renews his request for a full accounting of how, out of the thousands of patents the PTO issues every week, his '935 patent came to its attention, thus leading to the withdrawal of BlackLight's allowed applications.<sup>96</sup>

Applicant believes that concerns over outside influences on the prosecution of his applications are fully justified. Following the PTO's withdrawal action, counsel immediately investigated the facts and circumstances surrounding that action by questioning various PTO personnel. In discussions with Director Esther Kepplinger, she admitted to counsel that the withdrawal was a reaction to perceived heat—a "firestorm" as she put it—the PTO had received from an undisclosed outside source. Director Kepplinger further indicated that the withdrawal occurred only after BlackLight's '935 patent had been brought to the attention of then-Director Q. Todd Dickinson by Gregory Aharonian, another PTO outsider well known for publicly attacking issued U.S. patents.

Director Kepplinger's revelations are truly disturbing in that they describe what is, in essence, a newly created non-statutory reexamination procedure for opposing the issuance of patents never envisioned by Congress. *Compare* 35 U.S.C. §§ 301-307 (patent reexamination statutes).

This was but one of several issues Dr. Brewer raised in his letter to Director Rogan as a possible topic for discussion that the PTO says it is "not in a position to discuss . . . at the present time." The PTO's response, however, merely begs the question: if not now, when?

Following the PTO's drastic withdrawal action, Applicant discovered other reliable information suggesting outside interference with BlackLight's patent applications and breaches of the PTO's duty to maintain the confidentiality of those applications. Applicant learned that Dr. Peter Zimmerman, former Chief Scientist for the State Department, had published an Abstract of an upcoming speech to the American Physical Society (APS)—a BlackLight competitor—boasting that his Department and the Patent Office "have fought back with success" against BlackLight. [See Attachment

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<sup>96</sup> See Applicant's February 28, 2000 letter to Director Kepplinger documenting telephone and personal conversations between her and Applicant's counsel regarding improper outside influence that precipitated the withdrawal of BlackLight's five allowed applications. The PTO cited this letter in its March 22, 2000 Decision affirming its withdrawal action. [See Attachment G]

K, Tab C] In conversations with BlackLight's counsel, Dr. Zimmerman admitted that he had received information concerning BlackLight's applications through e-mails from Dr. Robert Park, spokesman for the APS, who told him of a contact in the PTO referred to by Dr. Park as "Deep Throat" with access to confidential patent information. [See Attachment K, Tab C]

An *APS News Online* bulletin, dated September 2002, suggests that Dr. Park is maintaining his questionable PTO contacts, apparently with the agency's blessing:

### **APS E-Board Passes Resolution on Perpetual Motion Machines**

The APS Executive Board approved a resolution at its June 2002 meeting in Annapolis, MD, affirming the fraudulent nature of claims of perpetual motion machines.

The resolution was deemed necessary because of a recent increase in patent applications for such devices. Robert Park, APS Director of Public Information and author of the weekly electronic newsletter, "What's New," reported that the US Patent Office has received several patent applications for perpetual motion machines during the first six months of this year alone. [Park's 2000 book, *Voodoo Science*, devoted considerable space to the phenomenon of such devices throughout history.] The text of the APS resolution follows.

The Executive Board of the American Physical Society is concerned that in this period of unprecedented scientific advance, misguided or fraudulent claims of perpetual motion machines and other sources of unlimited free energy are proliferating. Such devices directly violate the most fundamental laws of nature, laws that have guided the scientific progress that is transforming our world.

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[Attachment Q (emphasis added)] Dr. Park's knowledge of the number of pending patent applications filed in the PTO directed to a particular subject matter—information



that is supposedly kept confidential—raises additional questions as to his activities in interfering with the prosecution of U.S. patent applications.<sup>97</sup>

Of course, this should come as no surprise since Dr. Park has basically admitted his direct involvement in BlackLight's patent affairs, as evidenced by the September 6, 2002 issue of *What's New* he authored and published on the APS website:

The status of BlackLight Power's intellectual property is fuzzier than ever. BLP was awarded Patent 6,024,935 for "Lower-Energy Hydrogen Methods and Structures," a process for getting hydrogen atoms into a "state below the ground state". . . . You might expect these shrunken hydrogen atoms, called "hydrinos," to have a pretty special chemistry. Do they ever! Indeed, a second patent application titled "Hydride Compounds" had been assigned a number and BLP had paid the fee. Several other patents were in the works. That's when things started heading South. Prompted by an outside inquiry (who would do such a thing?), the patent director became concerned that this hydrino stuff required the orbital electron to behave "contrary to the known laws of physics and chemistry." The Hydride Compounds application [the '294 application] was withdrawn for further review and the other patent applications were rejected. [September 6, 2002 Online Newsletter of Dr. R. Park, *What's New* (Attachment C) (emphasis added)]

Dr. Park's startling admission was confirmed two weeks later in the September 20, 2002 issue of the *Online Newsletter* published by the James Randi Educational Foundation (JREF). In it, James Randi gleefully boasted about Dr. Park's contacting the Patent Office with the express purpose of sabotaging Applicant's patent rights:

But why, hard on the heels of re-examining other questionable patents (see three weeks ago on this page), would the Patent Office have happened upon this particular one [BlackLight's withdrawn '294 application], when there are so many in this category? The secret can be inferred from Bob Park's weekly column, where we find: "Prompted by an outside inquiry (who would do such a thing?) . . ." That rascal!

The very fact that the Patent Office has paid heed to the complaints that Park, the JREF, and others have made, speaks well for rationality. Let's hope that we can look forward to many quack devices and systems being re-evaluated. Let's see a lot more of this "extraordinary action" from the Director. As for BlackLight Power, says Park, "Their long-awaited IPO may have to wait a little longer." [September 20, 2002 Online Newsletter of the JREF, *Swift* (Attachment C) (emphasis added)]

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<sup>97</sup> Not coincidentally, the Committee initially attacked the operability of Applicant's invention by mischaracterizing it as a "perpetual motion machine" and, therefore, *per se* unpatentable. The Committee quickly withdrew that line of attack as Applicant showed it was completely lacking in any merit.

Despite all of this overwhelming incriminating evidence of improper outside interference by competitors with an administrative patent proceeding, the PTO prefers to ignore this matter. Apparently, this is not the first time that these same players—Dr. Park, James Randi and PTO officials—have been embroiled in a patent controversy such as this one involving improper interference with a patent proceeding. Less than a year before Applicant's five allowed applications were withdrawn from issue in February 2000, the PTO was caught up in another scandal of sorts involving the issuance of U.S. Patent Nos. 5,748,088 and 6,011,476, granted on a device that can identify the obscured location of living entities. Following issuance of the '088 patent, Dr. Park published in his *What's New* newsletter inaccurate, disparaging remarks, which were picked up by James Randi on his JREF website, concerning the operation and reliability of the claimed invention. An article published in *Science Magazine* during the pendency of the '476 patent also reported on the controversy and the involvement of Sandia National Labs (SNL) in the testing of the device. [Attachment D] That involvement and the disclosure of confidential information to David Voss, author of the *Science* article, was itself the subject of some controversy and resulted in the issuance of an internal PTO memorandum that was placed in the '476 patent file.

In that memorandum, the PTO felt compelled to reiterate its policy forbidding PTO employees from making public disclosures concerning pending patent applications:

#### PTO MEMORANDUM FOR ALL EMPLOYEES: MEDIA CONTACT POLICY

Posted Date: 06/25/99  
Removal Date: 07/06/99

UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office  
ASSISTANT SECRETARY AND COMMISSIONER OF PATENTS AND  
TRADEMARKS  
Washington, D.C. 20231

June 22, 1999

99-42

MEMORANDUM FOR All Employees

FROM: Acting Assistant Secretary of Commerce and Acting  
Commissioner of Patents and Trademarks

SUBJECT: Media Contact Policy

Since a memorandum on this subject was first issued several years ago, thousands of new employees have joined the PTO. Therefore, it is a good time to reiterate PTO policy concerning employee contact with members of the media including, but not limited to, those in print, broadcast, cable, and online publications.

All requests, including telephone and e-mail, from members of the media for interviews, tours, and appearances should be directed to the Office of Public Affairs (Richard Maulsby or Brigid Quinn). Public Affairs will then determine the appropriate Office response for such requests and arrange for all interviews and any other meetings with the media. A member of the Public Affairs staff may attend interviews and meetings.

This policy applies only to contact with the media, not to interactions with customers. Any questions about media contact should be directed to the Office of Public Affairs at 305-8341.

Additionally, MPEP section 1701 and TMEP section 1801 specify that Office personnel should not comment on the validity or enforceability of any U.S. patent or trademark registration. These sections also caution employees about answering other particular inquiries concerning U.S. patents or trademark registrations. Any questions on this policy should be directed to your supervisor or to the MPEP Editor at 305-8813 for patents or to the Office of the Assistant Commissioner for Trademarks at 308-8900. [Attachment E]

Curiously, SNL is where Dr. Park previously served as head of its Surface Physics Division, leading Applicant to wonder whether SNL, or any of its sister labs, have had any similar involvement in the examination of this and other BlackLight applications. Applicant's curiosity on this point is further heightened by the fact that Examiner Bernard Eng-Kie Souw, a former employee with Brookhaven National Labs, has been engaged in the examination of BlackLight's patent applications for some time now. [See, e.g., Serial No. 09/513,768]

If, as Applicant suspects, the PTO has conferred with anyone having ties to the APS, like Dr. Park or Dr. Zimmerman, or to other BlackLight competitors in withdrawing or rejecting BlackLight's applications, that information would be highly relevant and thus must be disclosed. Clearly, knowing the identity and potential biases of all persons providing input or otherwise involved in rejecting BlackLight's applications, especially those with competing interests, bears directly on the credibility of those rejections.

Applicant has, on numerous occasions, disclosed to PTO officials information relating to Dr. Park's undermining of BlackLight's patent rights, as relayed in Dr. Brewer's December 21, 2001 letter to then PTO Director Rogan, only to be ignored. [Attachment A. See also, for example, January 19, 2001 Letter to Director Kepplinger (Attachment K )] As Dr. Brewer explained in his letter, BlackLight is obviously concerned, among other things, that the PTO, once again, may have breached its duty to maintain confidentiality of U.S. patent applications under 35 U.S.C. § 122, 18 U.S.C. § 2071, 37 C.F.R. § 1.14, and M.P.E.P. § 101. The PTO's curt statement that it is "not in a position to discuss the issue at the present time" does little to allay those concerns.

Dr. Brewer further expressed in his letter distress over the suspected compromise of Applicant's patent rights to his novel hydrogen chemistry by a group of physicists with a vested interest in maintaining federal funding for projects based on a competing scientific theory and that those physicists continue to exert improper influence on the prosecution of BlackLight's pending applications.

Those suspicions are only fueled by continued PTO silence on these issues while it undercuts Applicant's patent rights based on statements of competitors like Dr. Park. For instance, In its March 22, 2000 Decision, the PTO justified its withdrawal action by relying, in part, on a *Washington Post* article written by Dr. Park only slightly more than a month prior to the withdrawal:

While petitioner in the accompanying letter points to favorable testimonials from scientists and entrepreneurs regarding the "revolutionary technology" that the instant application is asserted to embody, this does not establish that either the Director, Technology Center 1700, or the Director, Special Programs Law Office, committed reversible error, nor that the Notice should be withdrawn. In contrast, mainstream newspapers have reported this same "revolutionary technology" is accompanied by controversy in the scientific community. See Baard et al., Scientists and

entrepreneurs have lots of ideas about new sources of energy; some may even be practical, Wall St. J., Sept. 13, 1999, at R16; **Park, Perpetual motion; still going around, Washington Post, Jan. 12, 2000, at H3.** [March 22 Decision at 7 (Attachment G)]

Applicant is naturally skeptical that this timing was simply a coincidence. Regardless, the mere fact that the PTO would rely on any competitor to “bad-mouth” BlackLight’s technology is troubling. That it relied on Dr. Park of all people, known for conducting “hatchet jobs” on new technologies that threaten federal funding for the physicists he represents, is contemptible.

The same *Washington Post* that ran Dr. Park’s libelous article rebuked its less than credible author in a subsequent article confirming his reputation for engaging in what it described a “search-and-destroy mission” against inventors and scientists who seek to advance the bounds of science. [See Article dated June 25, 2000 (Attachment M)] To quote the article’s exact words, “Park’s anger permeates his rebuttals, which border on character assassination.” Noting that “thoroughness is not Park’s strong suit,” the article goes on to suggest that his intentions may be less than honorable:

Park’s failure to gather first-hand data is unfortunate, but his selective omissions are far more serious. In at least one case, he violated basic principles of journalism and science itself by apparently suppressing information that conflicts with his foregone conclusion. . . . Such tactics are reminiscent of the behavior of a zealous DA who is so convinced that a suspect is guilty that he feels entitled to withhold some information from the jury.

Dr. Park’s competitive motives in attacking BlackLight’s novel hydrogen chemistry, and thereby undermining its patent rights, are clear, as further recognized by the *Post* article in its description of Dr. Park as “a Washington lobbyist and PR flack for the American Physical Society.” The article goes on to warn of the serious effects a rush to judgment can have without first-hand review of experimental evidence:

This is a serious matter, since even poorly documented vitriol can jeopardize a scientist’s reputation and future funding if it is disseminated with the complicity of a respected organization such as the American Physical Society.

Incredibly, in rationalizing its withdrawal action, the PTO pays tribute to a “hatchet man” like Dr. Park, who never lets scientific evidence interfere with sabotaging

a competitor, by citing his hostile statements against BlackLight. Yet, in explaining the issuance of BlackLight's '935 patent, the PTO publicly denigrates its entire examining corps, known for their careful study of experimental evidence in deciding whether to issue U.S. patents:

[P]atent examiners do review [patent applications]. Unfortunately, patent examiners are swamped and sometimes things slip through. [Statement of Associate Solicitor Baer in *BlackLight Power, Inc. v. Q. Todd Dickinson*, May 22, 2000 Tr. at 7 (Attachment K, Tab A)]

[E]xaminers are under tremendous pressure to produce work, and if they're going to approve [an application], they just approve it and kind of let it out the door. [May 22, 2000 Tr. at 48 (Attachment K, Tab A)]

As Dr. Brewer pointed out in his letter to Director Rogan, the PTO, in making these outrageous public statements, undercuts the statutory presumption of validity that has, for well over 50 years, attached to every issued U.S. patent:

**Presumption of validity; defenses**

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

Underlying this statutory presumption is the premise of administrative regularity, which presumes that well-trained examiners with expertise in their respective fields properly carry out their examination duties by issuing only valid patents. See, e.g., American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1359 (Fed. Cir. 1984). This presumption was, in fact, confirmed by the capable work of Examiners Langel and Kalafut who, with over 50 years of experience between them, examined and allowed Applicant's '935 patent, along with BlackLight's withdrawn applications.<sup>98</sup>

As succinctly stated in Dr. Brewer's letter, Solicitor Baer's statements on behalf of the PTO should be alarming to just about everyone, with the possible exception of

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<sup>98</sup> The Examiners initially rejected all claims in these cases, but after conducting five lengthy personal interviews with Applicant and carefully considering Applicant's experimental evidence, they ultimately allowed those claims.

accused patent infringers, and most certainly do not reflect well on an agency charged with maintaining the integrity of the patent system. Applicant felt that a meeting with Director Rogan to secure a retraction of those statements would be mutually beneficial to both sides. Yet once again, inexplicably, the PTO was not, and presumably is still not, prepared to discuss this issue.

These and other unfair assaults on Applicant's patent rights leave him to ponder: What would motivate the PTO to conduct itself with such total disregard for U.S. patent laws and regulations governing its administrative authority just to attack this one Applicant?

Applicant's fear is that these attacks may be attributable to competitors, like Dr. Park, who are coordinating an organized smear campaign to discredit BlackLight's technology. That fear is only heightened by the PTO's hiding behind strained theoretical arguments as an excuse for refusing to fairly evaluate Applicant's experimental evidence, while using its Secret Committee to issue anonymous rejections in this and other BlackLight applications. Dr. Brewer also brought these issues to Director Rogan's attention as an agenda item for a meeting that, unfortunately, has never taken place.

Applicant, however, has a right to know the identity and qualifications of all persons providing input to, or otherwise participating in, the examination process. This information bears directly on the credibility of the rejections that have been entered in this and other BlackLight applications. For instance, if Dr. Park or any of his physicist cronies have been consulted in denying Applicant his patent rights, it would certainly explain the arbitrary and capricious handling of the experimental evidence of record in those cases.

Particularly germane is the identity of those persons responsible for, or otherwise involved in, creating the Office Actions, Attachments, and Appendices that make up the record in this application and other BlackLight cases. To this day, the Secret Committee has refused, without any adequate explanation, to provide this vital information to the detriment of Applicant.

Furthermore, Applicant is entitled to know which PTO officials are ultimately responsible for analyzing Applicant's scientific data evidencing the existence of lower-

energy hydrogen, and which officials have the final authority to decide the fate of BlackLight's applications. The Committee's unfair refusal to divulge that information has also seriously handicapped Applicant's ability to effectively respond to and overcome the rejections of record.

For instance, Applicant has been stymied on numerous occasions in attempts to discover the basis for various positions articulated by the Committee, or the status of certain actions it has taken. Seldom are the Examiners of record, who are mere signatories to the Committee's handiwork, or their immediate supervisors, able to give any useful guidance on those subjects, either because they have no authority to do so and cannot divulge who does, or, in some cases, they do not know who even has custody of the patent file so as to investigate the answer to a particular question.

Knowing who is responsible for analyzing the record evidence would also allow Applicant to assess that person's qualifications, as compared to those Ph.D. scientists who have peer reviewed the published experimental evidence confirming lower energy states of hydrogen. Equally important, by knowing who has authority to issue BlackLight's applications, Applicant can more easily ascertain and satisfy the patentability standards being applied in rejecting claims to his novel hydrogen technology.

Illustrating this last point, Applicant attempted to force the Secret Committee to set reasonable standards by which his data could be accepted as reliable proof by requesting the personal Interview that was held on February 21, 2001. Of course, to effectively determine the standards being applied against Applicant, he first had to identify the person(s) responsible for setting those standards.

Applicant, however, was only partially successful in that effort. Prior to the February 21 Interview, Applicant's counsel uncovered the identity of only one Committee member, Examiner Vasu Jagannathan, who played a role in rejecting BlackLight's applications. Incredibly, Examiner Jagannathan initially denied any such involvement, accurately noting that his name did not appear anywhere in the record. He therefore refused counsel's explicit request that he attend the upcoming Interview. Only after counsel wrote to a high-level supervisor demanding that Examiner Jagannathan attend did counsel receive confirmation that the Examiner was "directly involved in the



creation of the Office Action” to be discussed at the Interview and that he would indeed attend. [See January 19, 2001 letter to Director Esther Kepplinger (Attachment K) and February 12, 2001 Letter from Director Jacqueline M. Stone (Attachment N)]

Examiner Jagannathan confirmed his direct involvement by leading the Interview discussions. The Examiner’s participation afforded Applicant an opportunity to assess his qualifications to examine and evaluate the experimental evidence of record. Applicant was astonished to hear Examiner Jagannathan basically admit he was unqualified to do so based on several of his comments. One of those comments, as discussed previously, included his characterization of Applicant’s highly reliable spectroscopic data confirming lower energy states of hydrogen as a “bunch of squiggly lines.”

When pressed for guidance on what standards he used to evaluate Applicant’s scientific data and to decide whether to issue his patents, Examiner Jagannathan would not elaborate. Rather, he proposed a new standard requiring Applicant to submit and publish his data in peer-reviewed journal articles before he would give it serious consideration. Despite strenuous objections to this newly minted standard, Applicant nonetheless worked diligently to comply with it.

Over the subsequent three years, Applicant used vast resources to present experimental evidence of lower energy states of hydrogen—much of it generated by independent third parties—in over 50 peer-reviewed articles published in the prestigious scientific journals mentioned above. Despite this significant accomplishment, the Secret Committee, true to form, has essentially ignored that published evidence.

It should be further noted that Applicant has successfully met the Secret Committee’s new “publication” standard despite attempts by Applicant’s detractors, most notably Dr. Zimmerman, to undermine that effort. [See Attachment H] Applicant’s discovery that Dr. Zimmerman has been contacting various journals to dissuade publication of Applicant’s articles is especially alarming given that the Committee has relied on non-peer reviewed statements by him—statements that were posted in an internet chat room of all places and that he readily admits are biased—to reject claims in BlackLight applications.

If, as Applicant suspects, the Committee has cooperated with Dr. Zimmerman, or other such biased individuals, in denying Applicant his patent rights, while those same individuals have worked behind the scenes to undermine Applicant's compliance with the Committee's concocted publication requirement, again, that critical information should be disclosed without further delay.

Applicant is hardly surprised by his inability to break the PTO's code of silence on the suspicious handling of BlackLight's applications given that the PTO has stonewalled similar inquiries from five U.S. Senators—four of whom requested that Senator Patrick Leahy, Chairman of the Judiciary Committee overseeing the PTO, and/or Commerce Secretary Donald Evans, look into this matter. [See letters to and from Senators Max Cleland, Robert Torricelli, Jon Corzine, Ron Wyden, and Gordon Smith (Attachment O)] The PTO's continued refusal to respond to the Senators' inquiries suggests that, perhaps, it has something to hide.<sup>99</sup>

If the PTO looks to the Federal Circuit's June 28, 2002 Decision for license to continue its hostile prosecution through secret examination, it will not find it. Indeed, Judge Newman, in rationalizing her ruling, incorrectly assumed that the PTO would fairly and expeditiously prosecute BlackLight's applications:

Such action must of course be reasonable under the circumstances and rare in occurrence, lest the emergency become the rule. But when necessary in order to fulfill the PTO's mission, with safeguards to the interests of the applicant including fair and expeditious further examination, we agree with the district court that the action taken is a permissible implementation of the statute and regulation. [See *BlackLight Power* at pages 1537 (Attachment B) (emphasis added).]

Nothing could be further from the truth. As documented by Applicant, the PTO's prosecution of BlackLight's applications has been nothing short of hostile and its attempt to hide the mistreatment of Applicant behind the authority of a Secret

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<sup>99</sup> In the PTO's reply to the Senators' inquiry letters, Robert L. Stoll, Administrator for External Affairs, contended that any comments in response to those inquiries would be "inappropriate" because of the then-pending appeal to the Federal Circuit in *BlackLight Power Inc. v. Dickinson*, Civ. No. 00-0422 (D.D.C.). [See Attachment O] Putting aside the fact that the issues then on appeal had absolutely nothing to do with the points of inquiry, this contrived excuse has gone stale as the Federal Circuit decided that case in June 2002. [See Attachment B] By its own statements, nothing now prevents the PTO from cooperating with the U.S. Senate regarding the administrative irregularities brought to its attention.

Committee only exacerbates the unfairness of those actions. This untenable situation has failed to provide the safeguards to the interests of Applicant, including fair and expeditious further examination, contemplated by the Federal Circuit in its Decision and, therefore, has prompted Applicant to herein request an equitable remedy that the PTO immediately issue all five withdrawn BlackLight applications that gave rise to that Decision. [See Demand for Information and Redress, *infra*.]

Applicant strongly urges the PTO to break its silence and engage in an open and honest discussion on the merits of the issues that continue to plague BlackLight's remaining applications. Applicant renews his earlier commitment, as expressed in Dr. Brewer's December 21, 2001 letter, to meet with the PTO Director and/or any other government officials, anywhere, anytime, to resolve these outstanding issues. Applicant sincerely hopes that the Director will likewise commit himself to achieving the same objective so that a fair and expeditious prosecution of BlackLight's applications that safeguards Applicant's interests, as envisioned by the Federal Circuit, can finally move forward with mutually beneficial results.

Part of that forward movement should include proper consideration of the overwhelming experimental evidence confirming the utility and enablement of Applicant's claimed invention. In view of that evidence, Applicant submits that the rejections under 35 U.S.C. §§ 101 and 112 are misplaced and should be withdrawn, and that the present application is in condition for allowance.

#### **Discussions Held And Agreements Reached During The February 11, 2003 Interview**

The above-mentioned problems associated with the Secret Committee's examination of this and other BlackLight applications fall within the following four categories based on the Committee's failure to:

- (1) identify all persons from within and outside the Patent Office who contributed to, or were otherwise involved in, withdrawing or rejecting BlackLight's applications;
- (2) identify those persons having ultimate authority to analyze the vast body of experimental evidence demonstrating the existence of lower energy states of

hydrogen and, based on that analysis, for deciding whether to issue patents on Applicant's novel hydrogen technology;

- (3) establish and apply consistent patentability standards and guidelines by which that patentability decision is to be made; and
- (4) properly analyze the evidence of record—now published, or to be published, in over 50 peer-reviewed journal articles—that the Committee required Applicant to submit.

The Committee merely perpetuated those failures in its previous Office Actions by dismissing, without serious analysis, Applicant's submitted data evidencing lower energy states of hydrogen. Frustrated by the Committee's inaction, but still determined to get a fair hearing, Applicant requested and received the courtesy of another personal Interview, held February 11, 2003, to present his evidence and to discern the standards by which the ultimate decision-maker would be evaluating it.<sup>100</sup>

To that end, Applicant repeatedly requested that Examiner Jagannathan attend the Interview, since he had led the prior Interview held February 21, 2001, and, despite attempts to keep his identity secret, he was the only person known to have been directly involved in creating the substantive Office Actions of record. Specifically, Applicant sought to question Examiner Jagannathan on why he still refused to accept Applicant's scientific data evidencing lower-energy hydrogen after it had been published, or was soon to be published, in what was then over 40 (now over 50) peer-reviewed journal articles as required by the Examiner. Applicant, however, never got the chance to pose that question. Without explanation, Examiner Jagannathan refused to attend the Interview, just as he had refused to attend the Interview held two years earlier—only this time, he did not show up.

Applicant also requested that Examiners Wayne Langel and Stephen Kalafut attend the Interview, since they had previously allowed the five BlackLight applications that were mysteriously withdrawn from issue and their names were the only ones appearing in the record as signers of the substantive Office Actions under

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<sup>100</sup> Although the Interview Summary does not specifically list the serial number of all BlackLight applications as being the subject of the February 11, 2003 Interview, Examiners Langel and Kalafut agreed beforehand that the Interview would be held to address the similar rejection of claims in all assigned cases based on an alleged lack of utility and inoperability.

consideration. Examiners Langel and Kalafut did appear for the Interview, together with their immediate supervisors, SPE's Patrick Ryan and Stanley Silverman. Examiner William Wayner, who is assigned to one BlackLight application and expressed an interest in attending the Interview, also appeared.

Also attending the Interview and leading the discussions on the PTO's behalf was Quality Assurance Specialist Douglas McGinty, who until that time had never been identified to Applicant as having played any role in the examination of his applications.

Attending the Interview on behalf of BlackLight Power were the inventor, Dr. Randell L. Mills, his counsel, Jeffrey S. Melcher and Jeffrey A. Simenauer, and company Director Dr. Shelby Brewer.

Also attending the Interview as an observer at Applicant's request was Ted C. Liu, Senior Legislative Assistant for Congressman David Wu, who represents the 1<sup>st</sup> District of Oregon.

During the Interview, Applicant made a sincere effort to advance the prosecution of his applications and to find common ground upon which all of these cases, once again, would be allowed to issue as patents. Applicant believed it was a worthwhile effort in light of Examiner Langel's statements on the record reaffirming his consistent view that Applicant's novel hydrogen technology is fully operable and, therefore, entitled to patent protection. The Interview was also significant in view of the following representations and agreements that resulted from the discussions between Applicant and lead-Specialist McGinty:

- (1) Applicant will identify the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties;
- (2) the Examiners whose signatures appear on the rejections of record, *i.e.*, Examiners Langel, Kalafut, and Wayner, have full authority to review that data and, based on their review, to issue patents as deemed appropriate; and
- (3) Applicant will confer with the signatory Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the claims. For those claims determined to be adequately supported by the data, a patent will issue. For any claims deemed to be inadequately supported,

Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings.

Applicant appreciated the guidance Specialist McGinty provided during the Interview for securing BlackLight's patents. Based on that guidance, Applicant presented comments in several copending applications for which Responses were due detailing the substance of discussions held at the Patent Office on February 11<sup>th</sup> and identifying the independent, third-party data per agreement (1) above, which information is reproduced below. [U.S. Serial Nos. 09/110,678 and 09/362,693]

Applicant's comments confirmed Examiner Langel's long-held view that the claims in those cases were in condition for allowance. Applicant therefore requested that Examiner Langel exercise his authority to issue a Notice to that effect per agreement (2) above so that a patent could then be issued.

Following up on the Responses filed in those copending applications per agreement (3) above, Applicant arranged for an Interview with Examiner Langel to review the cases on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims in those cases. In fact, Applicant and Examiner Langel reached a tentative understanding that certain claims were adequately supported by the data and that Applicant was therefore entitled a patent.

Unfortunately for Applicant, that understanding was short-lived after Examiner Langel agreed, under the most grievous of circumstances, to his removal from examining all BlackLight applications to which he was assigned. Before discussing the negative aspects of that incident, however, Applicant presents the following recap of the discussions held during the February 11, 2003 Interview that lead to the above agreements.<sup>101</sup>

Just prior to the Interview, Specialist McGinty asked that Mr. Liu speak by telephone with Talis Dzenitis, a Congressional Affairs Specialist in the PTO's Legislative and International Affairs Office, to discuss his reasons for attending. Mr. Liu explained to Specialist Dzenitis that a constituent associated with BlackLight had contacted

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<sup>101</sup> Much of the substance of these discussions was confirmed in e-mail correspondence between Mr. Liu and Applicant's Counsel. [See Attachment P]

Congressman David Wu complaining of the irregular procedures the PTO has used in examining the company's pending patent applications. The procedures complained of included the PTO's withdrawal of the five applications approved by Examiners Langel and Kalafut for issuance as patents and the subsequent rejection of those and other BlackLight applications by an unknown group of PTO officials referred to by Applicant as a "Secret Committee."

Specialist Dzenitis represented to Mr. Liu that no such secret committee exists at the Patent Office. Applicant was surprised by that representation considering that a group of anonymous PTO officials are known to be handling BlackLight's applications and drafting the substantive Office Actions that the Examiners of record are instructed to sign.

Examiner Langel confirmed as much in an extended discussion he had with Mr. Liu and Applicant's counsel following the formal phase of the Interview. During that discussion, Examiner Langel repeated his prior denials of having authored the substantive Office Actions of record in the BlackLight applications to which he was assigned, even though those Actions bear his signature. Examiner Langel also repeated his previously expressed view that Applicant is entitled to patents on his novel hydrogen technology and that he wanted to issue those patents. Examiner Langel explained, however, that other PTO officials unknown to him having higher authority were responsible for drafting the substantive Office Actions he signed and for deciding whether to issue Applicant his patents.

The only person Examiner Langel could identify for Mr. Liu as "having something to do with the Office Actions" was Examiner Jagannathan, whose name does not appear on any Office Action. As noted above, Examiner Jagannathan kept his identity a secret from Applicant until counsel exposed his direct involvement in creating the Office Actions of record and forced him to attend the prior Interview that he led on February 21, 2001. When the recent February 11, 2003 Interview started, it was Specialist McGinty, another previously unidentified PTO official, who led the discussion.

Following the telephone conversation with Specialist Dzenitis, in which he denied the existence of a secret committee, Mr. Liu joined the Interview already in progress. Applicant began the Interview with a general discussion of his novel hydrogen

technology and a presentation of the experimental evidence confirming its operation and utility. Specifically, Applicant explained to the PTO officials in attendance how independent laboratory studies, including those conducted by a leading Los Alamos researcher and by a NASA funded group, as well as other highly reliable scientific data, demonstrate the existence of lower energy states of hydrogen underlying his technology.

At no time during Applicant's presentation did the PTO officials analyze or otherwise address to any significant degree the merits of that data proving the existence of lower-energy hydrogen. Rather, these officials—with the exception of Examiner Langel—raised non-technical arguments, similar to those raised in the pending Office Actions, why lower-energy hydrogen could not exist and, thus, why they were justified in according the real-world data little or no weight.

The first such argument, raised by Examiner Wayner, was based on unrelated technologies that have been subjected to ridicule in the scientific community, such as perpetual motion, cold fusion, and 100-miles-per-gallon carburetors. Examiner Wayner compared those controversial technologies to BlackLight's novel hydrogen chemistry and then asked Applicant: "How is your invention any different?"

Applicant pointed out significant differences. Unlike the wild inventions mentioned by Examiner Wayner, Applicant explained that BlackLight has actually reduced its inventions to practice, as demonstrated by the many working prototype energy cells developed over the past 10 years and the novel chemical compounds produced by the process, which were made available to the PTO in the past and again during the Interview. In fact, Applicant invited the PTO officials to visit his laboratory in Cranbury, New Jersey and witness the operation of his energy cell for themselves, but like prior invitations, this one too was ignored.

Applicant further distinguished his claimed inventions based on the substantial body of experimental evidence that corroborates the existence of lower energy states of hydrogen. Again, none of the PTO officials who raised non-technical arguments questioning the operability of Applicant's novel hydrogen technology made any real attempt to analyze that corroborating evidence. Indeed, Examiner Wayner frankly



admitted that his background was in Mechanical Engineering and, therefore, he was not qualified to conduct such an analysis.

Applicant acknowledges and appreciates Examiner Wayner's candor in this regard, which, as expressed throughout the Interview, has greatly assisted Applicant in flushing out the key problems discussed above that have plagued this and other BlackLight's applications since the Secret Committee took over examination of these cases.

Examiner Wayner also questioned why, if BlackLight's technology was such an important discovery, the company had not yet developed a commercial device for producing energy. Applicant explained the high cost of developing commercial products and, because BlackLight was not in that end of the business, it was looking to license patents on its technology to companies who were, once those patents are issued.

Concerned that Examiner Wayner might be introducing yet another new patentability standard—the requirement of a commercial product—before agreeing to issue a patent, counsel pressed the Examiner on whether that was his intention. Examiner Wayner plainly stated it was not and, in response to a specific question from Mr. Liu, affirmed that Applicant need not prove commercial applicability to secure a patent for his invention.

Applicant also became alarmed when Examiner Wayner referred generally to BlackLight's "detractors," but then specifically invoked only the name of APS lobbyist and spokesman, Dr. Robert Park, as someone who disputes the existence of lower energy states of hydrogen. Applicant's counsel wanted to raise issues relating to Dr. Park's "Deep Throat" contact in the Patent Office and his reputation for conducting "hatchet jobs" on new technologies that threaten his lobbying of hundreds of millions of dollars in federal funding for its pet projects. Specialist McGinty, however, cut counsel off, refusing to discuss the matter. When Specialist McGinty suggested that BlackLight has a "similar agenda," noting its recent NASA contract, Applicant corrected him, explaining that BlackLight does not receive any government funding for its research. Specialist McGinty had no response and the discussion moved onto other, less controversial subjects.

Examiner Wayner raised other issues regarding the reliability of the scientific evidence presented by Applicant. That evidence included spectroscopic data, which counsel described as being equivalent to a “chemical fingerprint.” Counsel further noted that Dr. Park himself, whom Examiner Wayner identified as BlackLight’s chief antagonist, has proclaimed the extraordinary reliability of spectroscopic data. [See *supra*.]

Yet when Applicant tried to present this highly reliable spectroscopic data at the Interview showing the spectral lines corresponding to lower-energy hydrogen, *i.e.*, a “hydrino” state, Examiner Wayner interrupted, stating that “spectroscopic lines are meaningless” and “don’t mean a hill of beans” to him.

Counsel again became concerned that BlackLight’s applications were being evaluated using rather loose patentability standards. Counsel therefore requested that the PTO officials provide some guidance regarding the evidentiary requirements they were imposing on Applicant. Specialist McGinty and Examiner Wayner at first did not respond directly to Counsel’s request for guidance, but rather began questioning the accuracy of the test data Applicant submitted to confirm the existence of lower energy hydrogen.

Applicant explained that the submitted test data was generated by highly qualified Ph.D. scientists, many of whom represent independent laboratories. Applicant further noted how this data had been extensively peer-reviewed in the 40-plus (now over 50) articles published, or soon to be published, in prestigious scientific journals, including the *Journal of Applied Physics*. Applicant also provided Specialist McGinty—much to his surprise—with specific data showing the lower-energy state spectral lines that were published in the prestigious spectroscopic publication, *Journal of Molecular Structure*.

Applicant was astounded by the refusal of Specialist McGinty and Examiner Wayner to accept the reliability of the scientific data appearing in these published journal articles, especially considering the PTO’s routine acceptance of evidence submitted in printed publications to overcome utility rejections. See, *e.g.*, MPEP § 2107.01 (VI) pp. 2100-33 (“An applicant can [submit evidence in response to a utility rejection] using any combination of the following: amendments to the claims, arguments

or reasoning, or new evidence submitted in an affidavit or declaration under 37 CFR 1.132, or in a **printed publication.**") (emphasis added).

Counsel further reminded the PTO officials of the standard imposed by lead-Examiner Jagannathan during the previous Interview held February 21, 2001 that conditioned his consideration of evidence of lower-energy hydrogen on its publication in peer-reviewed journal articles based on the reliability of the peer-review process.

Counsel then noted once again that, despite Examiner Jagannathan's failure to provide legal authority for imposing this inflated standard, Applicant had not only met, but had exceeded it with over 40 journal articles (now over 50). Having done so, counsel expressed extreme frustration with the PTO's continued refusal to seriously analyze the published scientific data based on manufactured excuses, such as this most recent one concerning the accuracy of the data.

Specialist McGinty raised yet another weak excuse for ignoring the published data by asking what assurances Applicant could provide that the journal articles had been actually peer reviewed! Mystified by that question, Applicant could only state what is a simple known fact: to get scientific data published in a journal article, it must first go through a rigorous peer-review process. Indeed, many of Applicant's articles went through numerous drafts and required further experimentation as directed by the Ph.D. scientists who peer reviewed those articles.

At that point in the Interview, Specialist McGinty admitted that, like Examiner Wayner, he was not qualified to analyze the published data. Applicant was surprised by that admission, since the Interview was being led by Specialist McGinty and had been arranged for the express purpose of presenting the experimental evidence of record.

Examiner McGinty's admission merely fueled Applicant's prior concerns that the published scientific data was not being properly considered, prompting counsel to ask who was responsible for analyzing that data. Specialist McGinty replied by stating that Examiners Langel and Kalafut, the Examiners of record, had that responsibility. That too came as a surprise, since Examiners Langel and Kalafut, of course, were the ones who had originally reviewed Applicant's experimental evidence in allowing the five BlackLight applications that were subsequently withdrawn from issue. Applicant, however, was relieved to learn that the two Examiners, with over 50 years of experience

between them and obviously qualified to analyze the published data, were being reassigned that task.

Counsel then addressed the vexing problem of changing standards for patentability imposed throughout the examination process. Counsel specifically mentioned, for example, the prior Office Action claiming Applicant's lower-energy hydrogen technology violated known laws of physics and chemistry without specifically identifying even one such law, and then requiring Applicant to prove otherwise.

Counsel also cited a recent Office Action dismissing Applicant's scientific data out of hand for failing to prove the invalidity of quantum theory:

The request for reconsideration has been entered and considered but does not overcome the rejection . . . because there is no evidence presented which would prove applicant's contention that the theory of quantum mechanics is invalid."  
[October 7, 2002 Advisory Action entered in U.S. Serial No. 09/110,717]

When Specialist McGinty accused Applicant of putting a "spin" on the Examiner's rejection, counsel noted that he had been reading the above quotation directly from the Office Action.

Counsel also mentioned recent Office Actions filed in BlackLight cases that dismissed Applicant's recent submission of peer-reviewed journal articles, in accordance with the standards imposed by Examiner Jagannathan, as being merely "cumulative" when it clearly was not and even the originally submitted evidence had not been properly analyzed.

Expressing frustration over the PTO's failure to provide any consistent patentability standards to guide Applicant, counsel once again requested that Specialist McGinty provide such guidance. Specialist McGinty again raised concern over the integrity of the experimental evidence, but indicated that he would be more receptive to that evidence if it was validated by independent third parties.<sup>102</sup>

Applicant explained to Specialist McGinty that much of the evidence submitted over the previous four years was, in fact, generated by independent third parties.

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<sup>102</sup> Just as Specialist McGinty sought assurances at the February 11 Interview that persons involved in generating and furnishing the scientific data submitted by Applicant are independent and unbiased, Applicant deserves similar assurances that those involved in rejecting BlackLight's applications are also independent and unbiased. Despite Applicant's repeated requests for such assurances, none have been forthcoming.

Applicant then began citing examples of the extensive independent third-party evidence disclosed in publications previously cited to the PTO, as well as some recently generated evidence, which has been submitted.<sup>103</sup> Specialist McGinty did not respond, whereupon counsel noted that his unfounded concern that the record evidence lacked third-party validation merely demonstrated the PTO's failure to thoroughly analyze that evidence.

Further demonstrating a lack of familiarity with the record evidence, Specialist McGinty criticized Applicant's experimental evidence as a whole by referring numerous times to only high-power plasma data. Applicant repeatedly pointed out that the plasma data was but a small fraction of the submitted evidence and that it was presented primarily to provide additional support for his plasma-related applications.

Applicant noted that the vast body of other scientific data he submitted relates to a broad range of analytical studies demonstrating the existence of lower energy states of hydrogen. For example, regarding those applications relating to novel chemical compounds, Applicant pointed Specialist McGinty to the extensive spectroscopic data supporting the identification of those compounds. Specialist McGinty, however, apparently did not understand the significance of that data, stating that the NMR data confirming lower-energy hydrogen could have been due to nitrogen. Applicant had to explain that, as a matter of basic scientific knowledge, NMR data only shows protons and that no other element but hydrogen is in the data range. Applicant also explained that the NMR data confirms the presence of an internal energy source.

Knowing that highly qualified Examiners Langel and Kalafut were once again responsible for analyzing the published data was reassuring. There still remained,

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<sup>103</sup> See R. L. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", *Int. J. Hydrogen Energy*, Vol. 26, No. 9, (2001), pp. 965-979.

R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", *J Mol. Struct.*, Vol. 643, No. 1-3, (2002), pp. 43-54.

J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", *Journal of Applied Physics*, submitted.

A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, [http://www.niac.usra.edu/files/studies/final\\_report/pdf/752Marchese.pdf](http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf).

however, one nagging issue, namely, who had the ultimate authority to issue Applicant his patents. Counsel expressed concern that the pending applications were being examined in secret and that, without knowing who had that authority, Applicant was being unfairly denied an opportunity to present his case to the actual decision-maker.

Specialist McGinty then stated in no uncertain terms that Examiners Langel, Kalafut, and Wayner, the signers of the Office Actions under consideration, had “full authority” to examine the pending applications and to issue the patents.

Upon hearing that statement, counsel immediately turned to Examiner Langel and asked him point blank whether, after having studied the experimental evidence of record, he still believes that BlackLight’s patent applications were allowable. The Examiner replied in no uncertain terms, “Yes, they’re still allowable.”

Counsel then asked Examiner Langel whether he was prepared to immediately allow the claims and issue Applicant his patents in those applications assigned to him, as is customary during an Interview, to which the Examiner replied, “Fine with me.”

Specialist McGinty, however, expressed uneasiness over Examiner Langel’s agreement to allow claims at the Interview. Specifically, he stated his concern that even if Applicant’s claimed technology were found to be operable, there were still issues of novelty and nonobviousness to be addressed before a patent could be issued.

Counsel was surprised by that statement given the PTO’s arguments over the prior three years that Applicant’s inventions were inoperable based on an incorrect assumption that lower-energy hydrogen cannot possibly exist. Counsel pointed out the obvious contradiction in now arguing that the Examiners may still need to conduct a prior art search for possible disclosure of Applicant’s lower-energy hydrogen technology.

Counsel further noted the PTO’s own examination guidelines requiring Examiners to evaluate the operability and utility of a claimed invention together with its novelty and nonobviousness following a complete prior art search. See MPEP § 706.<sup>104</sup>

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<sup>104</sup> MPEP § 706 provides in pertinent part:

After the application has been read and the claimed invention understood, a prior art search for the claimed invention is made. With the results of the prior art search, including any references provided by the applicant, the patent application should be reviewed and analyzed in conjunction

Counsel again turned to Examiner Langel to confirm whether that was his understanding. The Examiner replied that it was and indicated that, in fact, the first thing he did was to conduct a thorough prior art search because he thought that might be the easiest way to dispose of the applications assigned to him. Examiner Langel explained, however, that he was unable to reject the applications on prior art grounds, which was why he originally allowed them.

Counsel acknowledged Specialist McGinty's hesitation to issue Applicant patents covering his claims at the Interview and assured him that Applicant wanted to work with him to remove any lingering concerns. Counsel then specifically asked Specialist McGinty to articulate how they might proceed in trying to accomplish that mutually beneficial goal. In response, Specialist McGinty indicated that, in the next Response to the pending Office Actions, Applicant should focus on identifying the scientific data generated by independent third-party testing, as opposed to test data generated solely by Applicant. Counsel agreed to do that.

Specialist McGinty further expressed concern over whether that scientific data, even if assumed to be reliable, was commensurate with the scope of the claims of the various applications to adequately support patentability. Counsel stated that Applicant's data did adequately support the claimed subject matter. Counsel, however, recommended reviewing the claims of each application one by one with the assigned Examiners to see if at least some agreement could be reached as to those claims that are adequately supported and for which patents can be issued. As for any remaining claims that the Examiners believe are not adequately supported by the scientific data, Applicant would be free to seek such broader claim coverage through continued prosecution.

Specialist McGinty agreed that this was a reasonable way to proceed and granted a request by counsel, Mr. Simenauer, that this agreement be memorialized in writing in an attachment to the Interview Summary Form. Mr. Simenauer offered to draft

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with the state of the prior art to determine whether the claims define a useful, novel, nonobvious, and enabled invention that has been clearly described in the specification. The goal of examination is to clearly articulate any rejection early in the prosecution process so that the applicant has the opportunity to provide evidence of patentability and otherwise reply completely at the earliest opportunity.

this agreement, as is common practice, and Specialist McGinty enthusiastically accepted the offer. Mr. Simenauer then drafted the following Attachment as Specialist McGinty looked on:

**ATTACHMENT TO INTERVIEW SUMMARY FORM**

Applicant requested that the following points discussed at the Interview held on February 11, 2003 be included as an Attachment to the Interview Summary Form.

Applicant's counsel and the Examiners in attendance at the Interview agreed to meet again at a future date, either in person or by telephone, to continue discussions regarding the patentability of Applicant's pending patent applications. Specifically, the Examiners expressed concern that Applicant's experimental evidence be commensurate with the scope of the claims. To address that concern, Applicant's counsel agreed with the Examiners to go through the patent applications claim-by-claim with the Examiners and demonstrate how the scientific data supports those claims.

For those claims that are supported by the data, the PTO agrees to issue those claims. For those claims that the PTO determines are not supported by the data, Applicant will continue to seek that broader claim coverage in subsequent proceedings. [Attachment F]

After completing the two-page handwritten Attachment, Mr. Simenauer read it out loud in the presence of Specialist McGinty and Examiner Langel so that they could confirm its accuracy and make any necessary changes. When asked by counsel whether they were satisfied with the wording of the Attachment, Specialist McGinty stated that he was, as did Examiner Langel, who then signed each of the two pages. There was absolutely no confusion as to the agreement to issue patents for those claims found to be supported by the scientific data.

Incredibly, in a transparent attempt to rewrite history, some unknown PTO official apparently instructed Examiner Langel to sign a subsequent communication mailed over two weeks later, on February 26, 2003, that included an attached "Supplement to Interview Summary" (Attachment F), which provides in pertinent part:

The following is a supplement to the summary concerning the February 11, 2003 interview re 09/501,622, etc. . . . A two-page Interview Summary was provided by Examiner Langel. A two page "Attachment to Interview Summary



Form" also was provided by Mr. Simenauer. While the Attachment may represent the applicant's understanding of the interview, two points must be clarified.

First the second page of the applicant's attachment states in part: "for those claims that are supported by the data, the PTO agrees to issue those claims." The PTO made no such agreement. Instead, the PTO representatives indicated that the rejections under both 35 USC 101 and 112, 1<sup>st</sup> para., are outstanding and that evidence as to verification by credible, established, independent third parties would carry more persuasive weight.

Second, QAS Douglas McGinty was not listed in the Examiner's Interview Summary. He was present during the interview with the aforementioned attendees.

[signed] Wayne Langel  
Primary Examiner  
Art unit 1754

If PTO officials want to retract one of the key agreements reached at the Interview, they should expressly say so, identifying who made the decision and giving reasons for the retraction. Otherwise, Applicant has no choice but to rely on the accuracy of the contemporaneous written record.

Moreover, in view of other agreements reached at the Interview, the suggestion that there was no agreement to issue patents under the stated conditions is absurd—though hardly surprising given the sordid prosecution history of BlackLight's patent applications. Specialist McGinty plainly stated on the record that the Examiners who signed the outstanding rejections have full authority to review the data and to issue Applicant his patents. Also of record is Examiner Langel's unequivocal statement that, based on his review, he is prepared to issue those patents. To then force this same Examiner to sign a statement two weeks after the fact denying that "for those claims that are supported by the data, the PTO agrees to issue those claims" is, frankly, embarrassing.

Other ineffective arguments, such as those made by Examiner Kalafut in his Advisory Action dated April 2, 2003 filed in U.S. Serial No. 08/467,911, that "the present Examiner did not commit to any agreements during the interview" are also disappointing and, hopefully, will not be repeated. Applicant acknowledges that, to the best of his

recollection, Examiner Kalafut, although present at the February 11 Interview, did not speak a word. As previously indicated, it was Specialist McGinty who led the Interview on behalf of the PTO and it was he who ultimately agreed to the terms under which examination of BlackLight's patent applications would proceed, which terms were expressly reduced to writing. For Examiner Kalafut, or any of the Examiners present at the Interview, to now attempt to distance themselves from that agreement on the absurd grounds that they did not personally commit to it during the Interview merely illustrates yet another example of the PTO's arbitrary and capricious approach to examining BlackLight's patent applications.

**Applicant's Identification of Scientific Data Supporting Lower energy States of Hydrogen Generated and Furnished By Independent Third-Parties**

In light of the controversial prosecution history of this and other pending BlackLight cases, Applicant appreciated what seemed to be Specialist McGinty's willingness to set reasonable standards and guidelines by which Applicant's patents could finally be issued. Indeed, Applicant acknowledged and documented Specialist McGinty's concern over the reliability of the record evidence, including his requirement that Applicant identify independent third-party verification of the scientific data as noted in the Supplemental Interview Summary. With those standards and guidelines in mind, Applicant presented in several copending applications a summary of the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties, which is reproduced below along with additional, newly submitted data.<sup>105</sup>

**Experimental Evidence Generated by Independent Third Parties**

Applicant is unaware of any statutes, rules, or case law requiring that experimental evidence submitted by an Applicant in response to a rejection by the PTO be generated by independent third parties. Despite the higher standard imposed by Specialist McGinty requiring such third-party validation of the evidence, Applicant still has met and far exceeded this standard as shown below.

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<sup>105</sup> See, for example, U.S. Serial Nos. 09/110,678 and 09/362,693.

Applicant provides an alphabetical listing of independent third-party laboratories and universities that conducted the experiments and generated the scientific data relied upon and discussed in the 47 analytical studies that follow this list:

Advanced Research - Pirelli Labs, Milan, Italy

Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base

Atomic Energy Canada Limited, Chalk River Laboratories

Brookhaven National Laboratory

Charles Evans & Associates, Sunnyvale, CA

Charles Evans East, East Windsor, NJ

Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute

Franklin and Marshall College

Galbraith Laboratories, Inc., Knoxville, TN

Grace Davison, Columbia, MD

IC Laboratories, Amawalk, NY

Idaho National Engineering Laboratory

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany)

Jobin Yvon Inc., Edison, NJ

Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER)

Liebert Corporation, Division of Emerson Corporation

Los Alamos National Laboratory

Material Testing Laboratory, Pennington, NJ

MIT Lincoln Laboratories

Moscow Power Engineering Institute

NASA Lewis

National Research Council of Canada

PacifiCorp

Pennsylvania State University Chemical Engineering Department

Perkin-Elmer Biosystems, Framingham, MA

Pirelli Labs, Milan, Italy

Ricerca, Inc., Painesville, Ohio

Rider University, Lawrenceville NJ

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel

Ruhr University, Bochum, Germany

Shrader Analytical & Consulting Laboratories

Spectral Data Services, Inc., Champaign, IL

S. S. W., University of Western Ontario, Canada

Surface Science Laboratories, Mountain View, CA

Thermacore, Inc., Lancaster, PA

University of Delaware, Wilmington, DE

University of Massachusetts Amherst, Amherst, MA

University of New Mexico

Westinghouse Electric Corporation

Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University,  
Bethlehem, PA

The following 47 abstracts briefly describe the analytical studies of the scientific data generated by these independent third parties (highlighted in underline).

## Independent Test Results

47. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, Luca Gamberale, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", *European Physical Journal D*, submitted.

Luca Gamberale of the Advanced Research - Pirelli Labs, Milan, Italy performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of a chemically generated hydrogen plasma, extraordinarily broadened atomic hydrogen lines, lower-energy atomic, molecular, and molecular-ion hydrogen lines, the isolation and characterization of lower-energy molecular hydrogen gas, and excess power measured by water bath calorimetry were replicated. Specifically, plasmas of certain catalysts such as  $Sr^+$ ,  $Ar^+$ ,  $Ne^+$ , and  $He^+$  mixed with hydrogen were studied for evidence of a novel energetic reaction. A hydrogen plasma was observed to form at low temperatures (e.g.  $\approx 10^3 K$ ) and an extraordinary low field strength of about 1-2 V/cm when argon and strontium were present with atomic hydrogen. RF and microwave plasmas were used to generate  $He^+$ ,  $Ne^+$ , and  $Ar^+$  catalysts. Extraordinarily fast H (40-50 eV) was observed by Balmer  $\alpha$  line broadening only from plasmas having a catalyst with H. Novel extreme ultraviolet (EUV) emission lines were observed that corresponded to a Rydberg series of  $H$  corresponding to fractional principal quantum numbers wherein  $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$ ; ( $p \leq 137$  is an integer) replaces the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states. Corresponding emission due to fraction-principal-quantum-level hydrogen molecular ion  $H_2^+(1/p)$  and molecular hydrogen  $H_2(1/p)$  were also observed.  $H_2(1/p)$  gas was isolated by liquefaction using an high-vacuum ( $10^{-6}$  Torr) capable, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), visible and EUV optical emission spectroscopy (OES), and  $^1H$  NMR of the condensable gas dissolved in  $CDCl_3$  performed at Rider University, Lawrenceville NJ. Novel peaks were observed by cryogenic gas chromatography performed on the condensable gas which was highly pure hydrogen by MS and had a higher ionization energy than  $H_2$ . A unique EUV emission spectrum was observed by OES. The observation that the novel EUV emission spectrum shifted with deuterium substitution in a region where no hydrogen emission has ever been observed strongly supported the existence of lower-energy molecular hydrogen. Contaminants and exotic helium-hydrogen species were eliminated as the source of the reaction and

condensed gas plasma emission spectra. Upfield shifted NMR peaks were observed at 3.22, 3.25, and 3.47 ppm compared to that of  $H_2$  at 4.63 ppm. Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 44.3 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.9 W corresponding to 18.6 W of excess power in  $3\text{ cm}^3$ . The excess power density and energy balance were high,  $6.2\text{ W/cm}^3$  and  $-5 \times 10^4\text{ kJ/mole } H_2$  ( $240\text{ eV/H atom}$ ), respectively.

**46. R. Mills, B. Dhandapani, M. Nansteel, J. He, P. Ray, "Liquid-Nitrogen-Condensable Molecular Hydrogen Gas Isolated from a Catalytic Plasma Reaction", J. Phys. Chem. B, submitted.**

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of  $q \cdot 13.6\text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$  or these discrete energies less  $21.2\text{ eV}$  corresponding to inelastic scattering of these photons by helium atoms due to excitation of  $He(1s^2)$  to  $He(1s^1 2p^1)$ . These lines matched  $H(1/p)$ , fractional Rydberg states of atomic hydrogen, formed by a resonant nonradiative energy transfer to  $He^+$ . Corresponding emission due to the reaction  $2H(1/2) \rightarrow H_2(1/2)$  with vibronic coupling at  $E_{D+vib} = p^2 E_{D\text{ } H_2} \pm \left(\frac{\nu^*}{3}\right) E_{vib\text{ } H_2(\nu=0 \rightarrow \nu=1)}$ ,  $\nu^* = 1, 2, 3, \dots$  was observed at the longer wavelengths for  $\nu^* = 2$  to  $\nu^* = 32$  and at the shorter wavelengths for  $\nu^* = 1$  to  $\nu^* = 16$  where  $E_{D\text{ } H_2}$  and  $E_{vib\text{ } H_2(\nu=0 \rightarrow \nu=1)}$  are the experimental bond and vibrational energies of  $H_2$ , respectively. Fraction-principal-quantum-level molecular hydrogen  $H_2(1/p)$  gas was isolated by liquefaction using an high-vacuum ( $10^{-6}$  torr) capable, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), visible and EUV optical emission spectroscopy (OES), and  $^1H$  NMR of the condensable gas dissolved in  $CDCl_3$  performed at Rider University, Lawrenceville NJ.

Novel peaks were observed by cryogenic gas chromatography performed on the condensable gas which was highly pure hydrogen by MS and had a higher ionization energy than  $H_2$ . A unique EUV emission spectrum was observed by OES. The observation that the novel EUV emission spectrum shifted with deuterium substitution in a region where no hydrogen emission has ever been observed unequivocally confirmed the existence of lower-energy molecular hydrogen. Contaminants and exotic helium-hydrogen species were eliminated as the source of the reaction and condensed gas plasma emission spectra. Upfield shifted NMR peaks were observed at 3.22 and 3.47 ppm compared to that of  $H_2$  at 4.63 ppm. A theoretical rocketry propellant reaction is given that may be transformational.

45. **Dr. K.D. Keifer, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization by Liebert Corporation, (2001), and, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization, (2002).**

To separate reports disclosing the results of NMR, ToF-SIMS, XPS identification of novel hydrino hydride compounds and analysis of chemically-produced plasma by an expert hired by the Liebert Corporation, a division of the well-known and highly-respected Emerson Corporation. According to the expert's own words, he "observed demonstrations of the BlackLight Power (BLP) process and ...reached the inescapable conclusion that it is based on extraordinary chemical reactions that seem to release extraordinary amounts of energy.... It is [his] professional opinion that the BLP process represents a chemical conversion of atomic hydrogen unlike any previously reported [in] the archival scientific literature." Although the expert states that he was skeptical of Applicant's theory, he admitted that the chemical and plasma data did support Applicant's fractional quantum states and that he could offer no other explanation of the data using conventional quantum theory.

44. **A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002,**  
**[http://www.niac.usra.edu/files/studies/final\\_report/pdf/752Marchese.pdf](http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf).**

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

- i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,
- ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

**43. J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", Journal of Applied Physics, submitted.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. Water bath calorimetry was used to demonstrate one more peculiar phenomenon associated with a certain class of mixed gas plasmas termed resonant transfer, or rt-plasmas. Specifically,  $He/H_2(10\%)$  (500 mTorr),  $Ar/H_2(10\%)$  (500 mTorr), and  $H_2O(g)$  (200 mTorr) plasmas generated with an Evenson microwave cavity consistently yielded on the order of 50% more heat than non rt-plasma (controls) such as  $He$ ,  $Kr$ ,  $Kr/H_2(10\%)$ , under identical conditions of gas flow, pressure, and microwave operating conditions. The excess power density of rt-plasmas was of the order  $10\text{ W}\cdot\text{cm}^{-3}$ . In earlier studies with these same rt-plasmas it was demonstrated that other unusual features were present including dramatic broadening of the hydrogen Balmer series lines, unique vacuum ultraviolet (VUV) lines, and in the case of water plasmas, population inversion of the hydrogen excited states. Both the current results and the earlier results are completely consistent with the existence of a hitherto unknown exothermic chemical reaction, such as that predicted by Mills, occurring in rt-plasmas.



42. **R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Lin Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", Physics of Plasmas, submitted.**

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure ( $\sim 0.2$  Torr) water vapor plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant ( $> 2.5 \text{ \AA}$ ) hydrogen Balmer  $\alpha$  line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is notable that other aspects of the plasma including the  $OH^*$  rotational temperature and low electron concentrations are quite typical of plasmas of this type.

41. **H. Conrads, R. Mills, Th. Wrubel, "Emission in the Deep Vacuum Ultraviolet from a Plasma Formed by Incandescently Heating Hydrogen Gas with Trace Amounts of Potassium Carbonate", Plasma Sources Science and Technology, Vol. 12, (2003), pp. 389-395.**

The generation of a hydrogen plasma with intense extreme ultraviolet and visible emission was observed at Ruhr University, Bochum, Germany from low pressure hydrogen gas (0.1-1 mbar) in contact with a hot tungsten filament only when the filament heated a titanium dissociator coated with  $K_2CO_3$  above  $750^\circ\text{C}$ . The dissociator was electrically floated, and the electric field strength from the filament was about 1 V/cm, two orders of magnitude lower than the starting voltages measured for gas glow discharges. The emission of the  $H_\alpha$  and  $H_\beta$  transitions as well as the  $L_\alpha$  and  $L_\beta$  transitions were recorded and analyzed. The plasma seemed to be far from thermal equilibrium, and no conventional mechanism was found to explain the formation of a hydrogen plasma by incandescently

heating hydrogen gas with the presence of trace amounts of  $K_2CO_3$ . The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a fast decay of the electric field to zero. The plasma was found to be dependent on the chemistry of atomic hydrogen with potassium since no plasma formed with  $Na_2CO_3$  replacing  $K_2CO_3$  and the time constant of the emission following the removal of all of the power to the cell matched that of the cooling of the filament and the resulting shift from atomic to molecular hydrogen. Our results indicate that a novel chemical power source is present that forms the energetic hydrogen plasma. The plasma is a potential new light source.

**40. R. Mills, "Observation of Extreme Ultraviolet Emission from Hydrogen-KI Plasmas Produced by a Hollow Cathode Discharge", Int. J. Hydrogen Energy, Vol. 26, No. 6, (2001), pp. 579-592.**

A high voltage discharge of hydrogen with and without the presence of a source of potassium, potassium iodide, in the discharge was performed at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany) with a hollow cathode. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g.  $< 10^3$  K) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen,  $27.2$  eV [1, 3-5]. Two potassium ions or a potassium atom may each provide an electron ionization or transfer reaction that has a net enthalpy equal to an integer multiple of  $27.2$  eV. The spectral lines of atomic hydrogen were intense enough to be recorded on photographic films only when KI was present. EUV lines not assignable to potassium, iodine, or hydrogen were observed at 73.0, 132.6, 513.6, 677.8, 885.9, and 1032.9 Å. The lines are assigned to transitions of atomic hydrogen to lower energy levels corresponding to lower energy hydrogen atoms called hydrino atoms and the emission from the excitation of the corresponding hydride ions formed from the hydrino atoms.

**39. R. Mills, "Temporal Behavior of Light-Emission in the Visible Spectral Range from a Ti- $K_2CO_3$ -H-Cell", Int. J. Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 327-332.**

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany) reports the generation of a hydrogen plasma and extreme ultraviolet emission as recorded via the hydrogen Balmer emission in the visible range. Typically a hydrogen plasma is generated and the emission of extreme ultraviolet light from hydrogen gas is achieved via a discharge at high voltage, a high power inductively coupled plasma, or a plasma created and heated to

extreme temperatures by RF coupling (e.g.  $> 10^6 K$ ) with confinement provided by a toroidal magnetic field. The observed plasma formed at low temperatures (e.g.  $\approx 10^3 K$ ) from atomic hydrogen generated at a tungsten filament that heated a titanium dissociator coated with potassium carbonate. The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a fast decay of the electric field to zero. The persistence of emission following the removal of all of the power to the cell indicates that a novel chemical power source is present that forms an energetic plasma in hydrogen. No unusual behavior was observed with the control sodium carbonate.

**38. R. Mills, J. Sankar, P. Ray, J. He, A. Voigt, B. Dhandapani, "Synthesis and Characterization of Diamond Films from MPCVD of an Energetic Argon-Hydrogen Plasma and Methane ", J. of Materials Research, submitted.**

Polycrystalline diamond films were synthesized on silicon substrates by a low power (~80 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that  $Ar^+$  served as a catalyst with atomic hydrogen to form an energetic plasma.  $CH$ ,  $C_2$ , and  $C_3$  emissions were observed with significantly broadened  $H \alpha$  line. The average hydrogen atom temperature of a argon-hydrogen plasma was measured to be 110–130 eV versus  $\approx 3 eV$  for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the  $CO$  tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

**37. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", J. Phys. Chem. A, submitted.**

$2K^+$  to  $K + K^{2+}$  and  $K$  to  $K^{3+}$  provide a reaction with a net enthalpy equal to the one and three times the potential energy of atomic hydrogen, respectively. The presence of these gaseous ions or atoms with thermally dissociated hydrogen formed a so-called resonance transfer (rt) plasma having strong VUV emission with a stationary inverted Lyman population. Significant line broadening of the Balmer  $\alpha$ ,  $\beta$ , and  $\gamma$  lines of 18 eV was observed, compared to 3 eV from a hydrogen microwave plasma. Emission from rt-plasmas occurred even when the electric field applied to the plasma was zero as recorded at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany). The reaction was exothermic since excess power of  $20 \text{ mW} \cdot \text{cm}^{-3}$  was measured by Calvet calorimetry. An energetic catalytic reaction was proposed involving a resonant energy transfer between hydrogen atoms and  $2K^+$  or  $K$  to form very stable novel hydride ions  $H^-(1/p)$  called hydrino hydrides having a fractional principal quantum numbers  $p = 2$  and  $p = 4$ , respectively. Characteristic emission was observed from  $K^{2+}$  and  $K^{3+}$  that confirmed the resonant nonradiative energy transfer of  $27.2 \text{ eV}$  and  $3 \cdot 27.2 \text{ eV}$  from atomic hydrogen to  $2K^+$  and  $K$ , respectively.

The predicted binding energy of  $H^-(1/2)$  of  $3.0471 \text{ eV}$  with the fine structure was observed at  $4071 \text{ Å}$ , and its predicted bound-free hyperfine structure lines  $E_{\text{HF}} = j^2 3.00213 \times 10^{-5} + 3.0563 \text{ eV}$  ( $j$  is an integer) matched those observed for  $j = 1$  to  $j = 37$  to within a 1 part per  $10^4$ .  $H^-(1/4)$  was observed spectroscopically at  $110 \text{ nm}$  corresponding to its predicted binding energy of  $11.2 \text{ eV}$ . The  $^1\text{H}$  MAS NMR spectrum (Spectral Data Services, Inc., Champaign, IL) of novel compound  $KH^*Cl$  relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at  $-4.4$  corresponding to an absolute resonance shift of  $-35.9 \text{ ppm}$  that matched the theoretical prediction of  $p = 4$ . A novel NMR (Grace Davison, Columbia, MD and Spectral Data Services, Inc., Champaign, IL) peak of  $KH^*I$  at  $-1.5 \text{ ppm}$  relative to TMS corresponding to an absolute resonance shift of  $-33.0 \text{ ppm}$  matched the theoretical prediction of  $p = 2$ . The predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for  $H^-(1/2)$  and  $H^-(1/4)$  were found to be in agreement.

**36. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas", Polish Journal of Chemistry, submitted.**

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$  or these discrete energies less  $21.2 \text{ eV}$  corresponding to inelastic scattering of these photons by helium atoms due to excitation of  $\text{He}(1s^2)$  to  $\text{He}(1s^1 2p^1)$ .

These lines matched  $H(1/p)$ , fractional Rydberg states of atomic hydrogen, formed by a resonant nonradiative energy transfer to  $He^+$ . Corresponding emission due to the reaction  $2H(1/2) \rightarrow H_2(1/2)$  with vibronic coupling at  $E_{D+vib} = p^2 E_{D H_2} \pm \left(\frac{\nu^*}{3}\right) E_{vib H_2(\nu=0 \rightarrow \nu=1)}$ ,  $\nu^* = 1, 2, 3 \dots$

was observed at the longer wavelengths for  $\nu^* = 2$  to  $\nu^* = 32$  and at the shorter wavelengths for  $\nu^* = 1$  to  $\nu^* = 16$  where  $E_{D H_2}$  and  $E_{vib H_2(\nu=0 \rightarrow \nu=1)}$  are the experimental bond and vibrational energies of  $H_2$ , respectively. Fractional-principal-quantum-level molecular hydrogen  $H_2(1/p)$  gas was isolated by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), optical emission spectroscopy (OES), and  $^1H$  NMR (Rider University, Lawrenceville NJ) of the condensable gas dissolved in  $CDCl_3$ . The condensable gas was highly pure hydrogen by GC and MS and had a higher ionization energy than  $H_2$ . An upfield shifted NMR peak was observed at 3.25 ppm compared to that of  $H_2$  at 4.63 ppm. A theoretical rocketry propellant reaction is given that may be transformational.

**35. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Spectroscopic Characterization of the Atomic Hydrogen Energies and Densities and Carbon Species During Helium-Hydrogen-Methane Plasma CVD Synthesis of Single Crystal Diamond Films", Chemistry of Materials, Vol. 15, (2003), pp. 1313-1321.**

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of helium-hydrogen-methane (48.2/48.2/3.6%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA and Jobin Yvon Inc., Edison, NJ), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that  $He^+$  served as a catalyst with atomic hydrogen to form an energetic plasma.  $CH$ ,  $C_2$ , and  $C_3$  emissions were observed with significantly broadened  $H \alpha$ ,  $\beta$ ,  $\gamma$ , and  $\delta$  lines. The average hydrogen atom temperature of a helium-hydrogen-methane plasma was measured to be 120 - 140 eV versus  $\approx 3$  eV for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along

with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

**34. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Low Power MPCVD of Diamond Films on Silicon Substrates", Journal of Vacuum Science & Technology A, submitted.**

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of 10-30% hydrogen, 90-70% helium, and 1-10%  $CH_4$ . The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that  $He^+$  served as a catalyst with atomic hydrogen to form an energetic plasma. The average hydrogen atom temperature was measured to be 180-210 eV versus  $\approx 3$  eV for pure hydrogen. The electron temperature  $T_e$  for helium-hydrogen was 28,000 K compared to 6800 K for pure helium. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

**33. R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Spectroscopic Identification of Lithium Chloro Hydride", Materials Characterization, submitted.**

A novel inorganic hydride compound, lithium chloro hydride ( $LiHCl$ ), which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA),  $^1H$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

**32. R. L. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride", Solar Energy Materials & Solar Cells, in press.**

A novel highly stable hydrogen terminated silicon coating was synthesized by microwave plasma reaction of mixture of silane, hydrogen, and helium wherein it is proposed that  $He^+$  served as a catalyst with atomic hydrogen to form highly stable silicon hydrides. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large  $SiH^+$  peak in the positive spectrum and the dominant  $H^-$  in the negative spectrum. Since hydrogen is the only element with no primary element peaks, X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the  $H$  content of the  $SiH$  coatings as comprising novel silicon hydrides due to new peaks at 11, 43, and 55 eV in the absence of corresponding peaks of any candidate element at higher binding energies. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

**31. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Synthesis of HDLC Films from Solid Carbon", Thin Solid Films, submitted.**

Diamond-like carbon (DLC) films were synthesized on silicon substrates from solid carbon by a very low power (~60 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of 90-70% helium and 10-30% hydrogen. It is proposed that  $He^+$  served as a catalyst with atomic hydrogen to form an energetic plasma. The average hydrogen atom temperature of a helium-hydrogen plasma was measured to be 180-210 eV versus  $\approx 3$  eV for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of DLC. The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA). TOF-SIMS identified the coatings as hydride by the large  $H^+$  peak in the positive spectrum and the dominant  $H^-$  in the negative spectrum. The XPS identification of the  $H$  content of the  $CH$  coatings as a novel hydride corresponding to a peak at 49 eV has implications that the mechanism of the DLC formation may also involve

one or both of selective etching of graphitic carbon and the stabilization of  $sp^3$ -bonded carbon by the hydrogen catalysis product. Thus, a novel  $H$  intermediate formed by the plasma catalysis reaction may enhance the stabilization and etching role of  $H$  used in past methods.

**30. R. L. Mills, J. He, P. Ray, B. Dhandapani, X. Chen, "Synthesis and Characterization of a Highly Stable Amorphous Silicon Hydride as the Product of a Catalytic Helium-Hydrogen Plasma Reaction", Int. J. Hydrogen Energy, in press.**

A novel highly stable surface coating  $SiH(1/p)$  which comprised high binding energy hydride ions was synthesized by a microwave plasma reaction of a mixture of silane, hydrogen, and helium wherein it is proposed that  $He^+$  served as a catalyst with atomic hydrogen to form the highly stable hydride ions. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large  $SiH^+$  peak in the positive spectrum and the dominant  $H^-$  in the negative spectrum. X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the  $H$  content of the  $SiH$  coatings as hydride ions,  $H^-(1/4)$ ,  $H^-(1/9)$ , and  $H^-(1/11)$  corresponding to peaks at 11, 43, and 55 eV, respectively. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

The plasma which formed  $SiH(1/p)$  showed a number of extraordinary features. Novel emission lines with energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, \text{ or } 11$  were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, Vol. 27, No. 3, pp. 301-322]. These lines matched  $H(1/p)$ , fractional Rydberg states of atomic hydrogen where  $p$  is an integer, formed by a resonant nonradiative energy transfer to  $He^+$  acting as a catalyst. The average hydrogen atom temperature of the helium-hydrogen plasma was measured to be 180-210 eV versus  $\approx 3 \text{ eV}$  for pure hydrogen. Using water bath calorimetry, excess power was observed from the helium-hydrogen plasma compared to control krypton plasma. For example, for an input of 8.1 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 30.0 W corresponding to 21.9 W of excess power in  $3 \text{ cm}^3$ . The excess



power density and energy balance were high,  $7.3 \text{ W/cm}^3$  and  $-2.9 \times 10^4 \text{ kJ/mole H}_2$ , respectively. This catalytic plasma reaction may represent a new hydrogen energy source and a new field of hydrogen chemistry.

**29. R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Characterization of Lithium Chloro Hydride", Int. J. Hydrogen Energy, submitted.**

A novel inorganic hydride compound lithium chloro hydride,  $\text{LiHCl}$ , which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA),  $^1\text{H}$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

**28. R. Mills, E. Dayalan, P. Ray, B. Dhandapani, J. He, "Highly Stable Novel Inorganic Hydrides from Aqueous Electrolysis and Plasma Electrolysis", Electrochimica Acta, Vol. 47, No. 24, (2002), pp. 3909-3926.**

After  $10^4$  hours of continuous aqueous electrolysis with  $\text{K}_2\text{CO}_3$  as the electrolyte, highly stable novel inorganic hydride compounds such as  $\text{KHKHCO}_3$  and  $\text{KH}$  were isolated and identified by time of flight secondary ion mass spectroscopy (ToF-SIMS) (Charles Evans East, East Windsor, NJ). The existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) and solid state magic-angle spinning  $^1\text{H}$  nuclear magnetic resonance spectroscopy ( $^1\text{H}$  MAS NMR) (Spectral Data Services, Inc., Champaign, IL). A novel ion formed by plasma electrolysis of a  $\text{K}_2\text{CO}_3$ ,  $\text{Rb}_2\text{CO}_3$ , or  $\text{Cs}_2\text{CO}_3$  electrolyte was also observed by high resolution visible spectroscopy at 407.0 nm corresponding to its predicted binding energy of  $3.05 \text{ eV}$ .

**27. R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", Int. J. Hydrogen Energy, Vol. 26, No. 9, Sept. (2001), pp. 965-979.**

Novel inorganic alkali and alkaline earth hydrides of the formula  $\text{MH}^*$ ,  $\text{MH}_2$ , and  $\text{MH}^*\text{X}$  wherein  $M$  is the metal,  $X$ , is a halide, and  $\text{H}^*$  comprises a novel high binding

energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and  $MH$ ,  $MH_2$ , or  $MX$  corresponding to an alkali metal or alkaline earth metal compound, respectively. Novel hydride ions of the corresponding novel hydride compounds were characterized by an extraordinary upfield shifted peak observed by  $^1H$  nuclear magnetic resonance spectroscopy. The result were confirmed on five different instruments at five independent laboratories (Spectral Data Services, Inc., Champaign, IL, National Research Council of Canada, University of Massachusetts Amherst, Amherst, MA, University of Delaware, Wilmington, DE, and Grace Davison, Columbia, MD).

26. R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.

A novel inorganic hydride compound  $KHI$  which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and potassium iodide. Potassium iodo hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA),  $^1H$  and  $^{39}K$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), electrospray ionization time of flight mass spectroscopy (Perkin-Elmer Biosystems, Framingham, MA), liquid chromatography/mass spectroscopy (Ricerca, Inc., Painesville, Ohio), thermal decomposition with analysis by gas chromatography, and mass spectroscopy, and elemental analysis (Galbraith Laboratories, Inc., Knoxville, TN). Hydride ions with increased binding energies may form many novel compounds with broad applications.

25. R. Mills, "Novel Inorganic Hydride", *Int. J. of Hydrogen Energy*, Vol. 25, (2000), pp. 669-683.

A novel inorganic hydride compound  $KH KHCO_3$ , which is stable in water and comprises a high binding energy hydride ion was isolated following the electrolysis of a  $K_2CO_3$  electrolyte. Inorganic hydride clusters  $K[KH KHCO_3]^+$  were identified by Time of Flight Secondary Ion Mass Spectroscopy (Charles Evans East, East Windsor, NJ). Moreover, the existence of a novel hydride ion has been determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and  $^1H$  nuclear magnetic resonance spectroscopy

(Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

24. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", *Int. J. of Hydrogen Energy*, Vol. 26, No. 4, (2001), pp. 339-367.

Novel inorganic alkali and alkaline earth hydrides of the formula  $MHX$  and  $MHMX$  wherein  $M$  is the metal,  $X$ , is a singly negatively charged anion, and  $H$  comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and  $MX$  or  $MX_2$  corresponding to an alkali metal or alkaline earth metal, respectively. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g.  $\approx 10^3$  K) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1-5]. These atomized elements or certain gaseous ions comprised the catalyst to form  $MHX$  and  $MHMX$ . For example, atomic hydrogen was reacted with strontium vapor and  $SrBr_2$  to form  $SrHBr$ . Novel hydride compounds such as  $SrHBr$  were identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA),  $^1H$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and thermal decomposition with analysis by gas chromatography, and mass spectroscopy. Hydride ions with increased binding energies form novel compounds with potential broad applications such as a high voltage battery for consumer electronics and electric vehicles. In addition, these novel compositions of matter and associated technologies may have far-reaching applications in many industries including chemical, electronics, computer, military, energy, and aerospace in the form of products such as propellants, solid fuels, surface coatings, structural materials, and chemical processes.

23. R. Mills, "Highly Stable Novel Inorganic Hydrides", *Journal of New Materials for Electrochemical Systems*, Vol. 6, (2003), pp. 45-54.

Novel inorganic hydride compounds  $KHKHCO_3$  and  $KH$  were isolated following the electrolysis of a  $K_2CO_3$  electrolyte. The compounds which comprised high binding energy hydride ions were stable in water, and  $KH$  was stable at elevated temperature (600 °C). Inorganic hydride clusters  $K[KHKHCO_3]^+$  were identified by positive Time of Flight Secondary Ion Mass Spectroscopy (ToF-SIMS) of  $KHKHCO_3$  (Charles Evans East, East Windsor, NJ). The negative ToF-SIMS was dominated by hydride ion. The positive and

negative ToF-SIMS of  $KH$  showed essentially  $K^+$  and  $H^-$  only, respectively. Moreover, the existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and  $^1H$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

**22. R. Mills, "Novel Hydrogen Compounds from a Potassium Carbonate Electrolytic Cell", *Fusion Technology*, Vol. 37, No. 2, March, (2000), pp. 157-182.**

Novel compounds containing hydrogen in new hydride and polymeric states which demonstrate novel hydrogen chemistry have been isolated following the electrolysis of a  $K_2CO_3$  electrolyte with the production of excess energy. Inorganic hydride clusters  $K[KH_2KHC_3]^+$  and hydrogen polymer ions such as  $OH_{23}^+$  and  $H_{16}^-$  were identified by time of flight secondary ion mass spectroscopy (Charles Evans East, East Windsor, NJ). The presence of compounds containing new states of hydrogen were confirmed by X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), X-ray diffraction, Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), Raman spectroscopy (Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute), and  $^1H$  nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL).

**21. Mills, R., Good, W., "Fractional Quantum Energy Levels of Hydrogen", *Fusion Technology*, Vol. 28, No. 4, November, (1995), pp. 1697-1719.**

Determination of excess heat release during the electrolysis of aqueous potassium carbonate by the very accurate and reliable method of heat measurement, flow calorimetry; describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by X-ray Photoelectron Spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA); describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by emissions of soft X-rays from dark matter; describes the experimental identification of hydrogen molecules in fractional quantum energy levels—dihydrino molecules by high resolution magnetic sector mass spectroscopy with ionization energy determination, and gives a summary.

In summary:

Excess power and heat were observed during the electrolysis of aqueous potassium carbonate. Flow calorimetry of pulsed current electrolysis of aqueous potassium carbonate at a nickel cathode was performed in a single-cell dewar. The average power out of 24.6 watts exceeded the average input power (voltage times current) of 4.73 watts by a factor greater than 5. The total input energy (integration of voltage times current) over the entire duration of the experiment was 5.72 MJ; whereas, the total output energy was 29.8 MJ. No excess heat was observed when the electrolyte was changed from potassium carbonate to sodium carbonate. The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to quantized energy levels below the conventional "ground state". These lower energy states correspond to fractional quantum numbers:  $n = 1/2, 1/3, 1/4, \dots$ . Transitions to these lower energy states are stimulated in the presence of pairs of potassium ions ( $K^+/K^+$  electrocatalytic couple) which provide 27.2 eV energy sinks.

The identification of the  $n = 1/2$  hydrogen atom,  $H(n = 1/2)$  is reported. Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA). A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of  $H(n = 1/2)$  is 54.4 eV. Thus, the theoretical and measured binding energies for  $H(n = 1/2)$  are in excellent agreement.

Further experimental identification of hydrinos—down to  $H(n = 1/8)$ —can be found in the alternative explanation by Mills et al. for the soft X-ray emissions of the dark interstellar medium observed by Labov and Bowyer [Labov, S., Bowyer, S., "Spectral observations of the extreme ultraviolet background", *The Astrophysical Journal*, 371, (1991), pp. 810-819] of the Extreme UV Center of the University of California, Berkeley. The agreement between the experimental spectrum and the energy values predicted for the proposed transitions is remarkable.

The reaction product of two  $H(n=1/2)$  atoms, the dihydrino molecule, was identified by mass spectroscopy (Shrader Analytical & Consulting Laboratories). The mass spectrum of the cryofiltered gases evolved during the electrolysis of a light water  $K_2CO_3$  electrolyte with a nickel cathode demonstrated that the dihydrino molecule,  $H_2\left(n = \frac{1}{2}\right)$ , has a higher ionization energy, about 63 eV, than normal molecular hydrogen,  $H_2(n = 1)$ , 15.46 eV. The high resolution (0.001 AMU) magnetic sector mass spectroscopic analysis of the postcombustion gases indicated the presence of two peaks of nominal mass two-- one peak at 70 eV and one peak at 25 eV. The same analysis of molecular hydrogen indicates only one peak at 25 eV and one peak at 70 eV. In the case of the

postcombustion sample at 70 eV, one peak was assigned as the hydrogen molecular ion peak,  $H_2^+(n=1)$ , and one peak was assigned as the dihydrino molecular peak,  $H_2^+\left(n=\frac{1}{2}\right)$  which has a slightly larger magnetic moment.

**20. Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994).**

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed by Thermacore, Inc., Lancaster, PA. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions. The pH, specific gravity, concentration of  $K_2CO_3$ , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

The "ash" of the exothermic reaction is atoms having electrons of energy below the "ground state" which are predicted to form molecules. The predicted molecules were identified by lack of reactivity with oxygen, by separation from molecular deuterium by cryofiltration, and by mass spectroscopic analysis. The combustion of the gases evolved during the electrolysis of a light water  $K_2CO_3$  electrolyte ( $K^+/K^+$  electrocatalytic couple) with a nickel cathode was incomplete. The mass spectroscopic analysis (Dr. David Parees of Air Products & Chemicals, Inc.) of the  $m/e = 2$  peak of the combusted gas demonstrated that the dihydrino molecule,  $H_2(n = 1/2)$ , has a higher ionization energy than  $H_2$ .

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by HydroCatalysis Power Corporation. Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

**19. V. Noninski, Fusion Technol., Vol. 21, 163 (1992).**

Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)] as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ( $\approx 50\text{ }^{\circ}\text{C} / \text{W}$  versus  $\approx 30\text{ }^{\circ}\text{C} / \text{W}$ ), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

**18. Niedra, J., Meyers, I., Fralick, G. C., and Baldwin, R., "Replication of the Apparent Excess Heat Effect in a Light Water-Potassium Carbonate-Nickel Electrolytic Cell, NASA Technical Memorandum 107167, February, (1996). pp. 1-20.; Niedra, J., Baldwin, R., Meyers, I., NASA Presentation of Light Water Electrolytic Tests, May 15, 1994.**

NASA Lewis tested a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] with the exception that it was minus the central cathode. A cell identical to the test cell with heater power only (no electrolysis) was the calibration control and the blank cell with the heater power equal to zero. The test cell was also calibrated "on the fly" by measuring the temperature relative to the blank cell at several values of heater input power of the test cell. "Replication of experiments claiming to demonstrate excess heat production in light water-Ni- $\text{K}_2\text{CO}_3$  electrolytic cells was found to produce an apparent excess heat of 11 W maximum, for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68." The production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power.

**17. Technology Insights, 6540 Lusk Boulevard, Suite C-102, San Diego, CA 92121, "HydroCatalysis Technical Assessment Prepared for PacifiCorp", August 2, 1996.**

This report documents a technical assessment of a novel source of hydrogen energy advanced by HydroCatalysis Power Corporation now BlackLight Power, Inc. (BLP). The assessment was conducted as part of the due diligence performed for PacifiCorp. It was conducted by a literature search and review, site visits to BLP and collaborating organizations, and telephone interviews with others active in the general area. A description of concept is provided in Section 3. Section 4 presents an assessment of the concept

background, supporting theory, laboratory prototypes, projected initial products, and economic and environmental aspects. Section 5 documents the results of telephone interviews and site visits. An overall summary and conclusions are presented in the following section.

**16. P. M. Jansson, "HydroCatalysis: A New Energy Paradigm for the 21st Century", Thesis Submitted in partial fulfillment of the requirements of the Masters of Science in Engineering Degree in the Graduate Division of Rowan University, May 1997, Thesis Advisors: Dr. J. L. Schmalzel, Dr. T. R. Chandrupatla, and Dr. A. J. Marchese, External Advisors: Dr. J. Phillips, Pennsylvania State University, Dr. R. L. Mills, BlackLight Power, Inc., W. R. Good, BlackLight Power, Inc.**

This thesis reviews the problems of worldwide energy supply, describes the current technologies that meet the energy needs of our industrial societies, summarizes the environmental impacts of those fuels and technologies and their increased use by a growing global and increasing technical economy. The work also describes and advances the technology being developed by BlackLight Power, Inc. (BLP) a scientific company located in Princeton, New Jersey. BLP's technology proports to offer commercially viable and useful heat generation via a previously unrecognized natural phenomenon - the catalytic reduction of the hydrogen atom to a lower energy state. Laboratory tests obtained as original research of this thesis as well as the review of the data of others substantiate the fact that replication of the experimental conditions which are favorable to initiating and sustaining the new energy release process will generate controllable, reproducible, sustainable and commercial meaningful heat. For example, Jansson has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. Approximately  $10^{-3}$  moles of hydrogen was admitted to a  $20\text{ cm}^3$  Calvet cell containing a heated platinum filament and  $KNO_3$  powder. In the three separate trials with a platinum filament hydrogen dissociator which was varied in length of 10 cm, 20 cm, and 30 cm, a mean power of 0.581, 0.818, and 1.572 watts was observed, respectively. The closed experiments were run to completion. The energy observed was 622, 369, and 747 kJ, respectively, This is equivalent to the generation of  $6.2 \times 10^8\text{ J/mole}$ ,  $3.7 \times 10^8\text{ J/mole}$ , and  $7.5 \times 10^8\text{ J/mole}$  of hydrogen, respectively, as compared to  $2.5 \times 10^5\text{ J/mole}$  of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be at least 1000 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model. Convincing evidence is presented to lead to the conclusion that BLP technology has



tremendous potential to achieve commercialization and become an energy paradigm for the next century. The research was also conducted as part of the due diligence performed for Atlantic Energy now Conectiv.

- 15. Phillips, J., Smith, J., Kurtz, S., "Report On Calorimetric Investigations Of Gas-Phase Catalyzed Hydrino Formation" Final report for Period October-December 1996", January 1, 1997, A Confidential Report submitted to BlackLight Power, Inc. provided by BlackLight Power, Inc., Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. In three separate trials, between 10 and 20 K Joules were generated at a rate of 0.5 Watts, upon admission of approximately  $10^{-3}$  moles of hydrogen to the 20  $cm^3$  Calvet cell containing a heated platinum filament and  $KNO_3$  powder. This is equivalent to the generation of  $10^7$  J/mole of hydrogen, as compared to  $2.5 \times 10^5$  J/mole of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be 100 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model.

- 14. Phillips, J., Shim, H., "Additional Calorimetric Examples of Anomalous Heat from Physical Mixtures of K/Carbon and Pd/Carbon", January 1, 1996, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of ionic hydrogen spillover catalytic material: 40% by weight potassium nitrate ( $KNO_3$ ) on graphitic carbon powder with 5% by weight 1%-Pd-on-graphitic carbon ( $K^+/K^+$  electrocatalytic couple) by the very accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst. However, no excess power was observed with flowing helium over the catalyst mixture. Rates of heat production were reproducibly observed which were higher than that expected from the conversion of all the hydrogen entering the cell to water, and the total energy observed was over four times larger than that expected if all the catalytic material in

the cell were converted to the lowest energy state by "known" chemical reactions. Thus, "anomalous" heat, heat of a magnitude and duration which could not be explained by conventional chemistry, was reproducibly observed.

- 13. Bradford, M. C., Phillips, J., "A Calorimetric Investigation of the Reaction of Hydrogen with Sample PSU #1", September 11, 1994, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of nickel oxide powder containing strontium niobium oxide ( $\text{Nb}^{3+}/\text{Sr}^{2+}$  electrocatalytic couple) by the very accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst which increased with increasing flow rate. However, no excess power was observed with flowing helium over the catalyst/nickel oxide mixture or flowing hydrogen over nickel oxide alone. Approximately 10 cc of nickel oxide powder containing strontium niobium oxide immediately produced 0.55 W of steady state output power at 523 K. When the gas was switched from hydrogen to helium, the power immediately dropped. The switch back to hydrogen restored the excess power output which continued to increase until the hydrogen source cylinder emptied at about the 40,000 second time point. With no hydrogen flow the output power fell to zero.

The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to quantized energy levels below the conventional "ground state". These lower energy states correspond to fractional quantum numbers:  $n = 1/2, 1/3, 1/4, \dots$ . Transitions to these lower energy states are stimulated in the presence of pairs of niobium and strontium ions ( $\text{Nb}^{3+}/\text{Sr}^{2+}$  electrocatalytic couple) which provide 27.2 eV energy sinks.

- 12. Jacox, M. G., Watts, K. D., "The Search for Excess Heat in the Mills Electrolytic Cell", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, January 7, 1993.**

Idaho National Engineering Laboratory (INEL) operated a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] except that it was minus the central cathode and that the

cell was wrapped in a one-inch layer of urethane foam insulation about the cylindrical surface. The cell was operated in a pulsed power mode. A current of 10 amperes was passed through the cell for 0.2 seconds followed by 0.8 seconds of zero current for the current cycle. The cell voltage was about 2.4 volts, for an average input power of 4.8 W. The electrolysis power average was 1.84 W, and the stirrer power was measured to be 0.3 W. Thus, the total average net input power was 2.14 W. The cell was operated at various resistance heater settings, and the temperature difference between the cell and the ambient as well as the heater power were measured. The results of the excess power as a function of cell temperature with the cell operating in the pulsed power mode at 1 Hz with a cell voltage of 2.4 volts, a peak current of 10 amperes, and a duty cycle of 20 % showed that the excess power is temperature dependent for pulsed power operation, and the maximum excess power was 18 W for an input electrolysis joule heating power of 2.14 W. Thus, the ratio of excess power to input electrolysis joule heating power was 850 %. INEL scientists constructed an electrolytic cell comprising a nickel cathode, a platinized titanium anode, and a 0.57 M  $K_2CO_3$  electrolyte. The cell design appears in Appendix 1. The cell was operated in the environmental chamber in the INEL Battery Test Laboratory at constant current, and the heat was removed by forced air convection in two cases. In the first case, the air was circulated by the environmental chamber circulatory system alone. In the second case, an additional forced air fan was directed onto the cell. The cell was equipped with a water condenser, and the water addition to the cell due to electrolysis losses was measured. The data of the forced convection heat loss calorimetry experiments during the electrolysis of a 0.57 M  $K_2CO_3$  electrolyte with the INEL cell showed that 13 W of excess power was produced. This excess power could not be attributed to recombination of the hydrogen and oxygen as indicated by the equivalence of the calculated and measured water balance.

**11. Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994.**

Westinghouse Electric Corporation reports that excess heat was observed during the electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) where the electrolysis of aqueous sodium carbonate served as the control. The data of the temperature of the cell minus the ambient temperature shows that when potassium carbonate replaced sodium carbonate in the same cell with the same input electrolysis power, the potassium experiment was twice as hot as the sodium carbonate experiment for the duration of the experiment, one month. The net faraday efficiency of gas evolution was experimentally

measured to be unity by weighing the experiment to determine that the expected rate of water consumption was observed. The output power exceeded the total input power. The data was analyzed by HydroCatalysis Power Corporation [Mills, R., Analysis by HydroCatalysis Power Corporation of Westinghouse Report Entitled "Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC", February 25, 1994].

**10. Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995.**

During the electrolysis of aqueous potassium carbonate, researchers working at MIT Lincoln Laboratories observed long duration excess power of 1-5 watts with output/input ratios over 10 in some cases with respect to the cell input power reduced by the enthalpy of the generated gas. In these cases, the output was 1.5 to 4 times the integrated volt-ampere power input. Faraday efficiency was measured volumetrically by direct water displacement.

**9. Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.; "Calorimetry for a  $\text{Ni}/\text{K}_2\text{CO}_3$  Cell", Atomic Energy Canada Limited, Chemical Engineering Branch, Chalk River Laboratories, Chalk River, Ontario, June 1994.**

Atomic Energy Canada Limited, Chalk River Laboratories, report that 128 % and 138% excess heat were observed in separate experiments by flow calorimetry during the electrolysis of aqueous potassium carbonate ( $\text{K}^+/\text{K}^+$  electrocatalytic couple) in a closed cell, and that 138% was observed in an open cell.

**8. Shaubach, R. M., Gernert, N. J., "Anomalous Heat From Hydrogen in Contact with Potassium Carbonate", Thermacore Report, March 1994.**

A high temperature/high pressure/high power density industrial prototype gas cell power generator which produced 50 watts of power at 300 °C having a nickel surface area of only 300 cm<sup>2</sup> was successfully developed. A sample of the nickel tubing of the aqueous potassium carbonate permeation cell was analyzed by XPS at the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present; whereas, the control nickel tube showed no feature. The binding energy (in vacuum) of  $\text{H}(n = 1/2)$  is 54.4 eV. Thus, the theoretical and measured binding energies for  $\text{H}(n = 1/2)$  are in excellent agreement. No excess energy or 54.6 eV feature were observed when sodium carbonate replaced potassium carbonate.

7. **Gernert, N., Shaubach, R. M., Mills, R., Good, W., "Nascent Hydrogen: An Energy Source," Final Report prepared by Thermacore, Inc., for the Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Contract Number F33615-93-C-2326, May, (1994).**

In a report prepared for the Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Thermacore reports, "anomalous heat was observed from a reaction of atomic hydrogen in contact with potassium carbonate on a nickel surface. The nickel surface consisted of 500 feet of 0.0625 inch diameter tubing wrapped in a coil. The coil was inserted into a pressure vessel containing a light water solution of potassium carbonate. The tubing and solution were heated to a steady state temperature of 249 °C using an I<sup>2</sup>R heater. Hydrogen at 1100 psig was applied to the inside of the tubing. After the application of hydrogen, a 32 °C increase in temperature of the cell was measured which corresponds to 25 watts of heat. Heat production under these conditions is predicted by the theory of Mills where a new species of hydrogen is produced that has a lower energy state than normal hydrogen. ESCA analysis, done independently by Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, have found the predicted 55 eV signature of this new species of hydrogen."

6. **Wiesmann, H., Brookhaven National Laboratory, Department of Applied Science, Letter to Dr. Walter Polansky of the Department of Energy Regarding Excess Energy Verification at Brookhaven National Laboratory, October 16, 1991.**

Calorimetry of continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cell by Noninski at Brookhaven National Laboratory. Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using a resistor, even though the power dissipated is equal in both cases. According to Dr. Mills' theory, this apparent "excess power" is due to the fact that the electron in a hydrogen atom can "decay" to stable subinterger quantum levels. Dr. Noninski demonstrated this thermal effect at BNL." The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

**5. Nesterov, S. B., Kryukov, A. P., Moscow Power Engineering Institute Affidavit, February, 26, 1993.**

The Moscow Power Engineering Institute experiments showed 0.75 watts of heat output with only 0.3 watts of total power input (power = VI) during the electrolysis of an aqueous potassium carbonate electrolyte with a nickel foil cathode and a platinized titanium anode. Excess power over the total input on the order of 0.45 watts was produced reliably and continuously over a period of three months. Evaluation of the electrolyte after three months of operation showed no significant change in its density or molar concentration. The cell was disassembled and inspected after over one month of operation at 0.1 amperes. This inspection showed no visible signs of a reaction between the electrodes and the electrolyte. The cell was re-assembled and operated as before. Excess energy was produced for the three month duration of the experiment. Scintillation counter measurements showed no signs of radiation external to the cell.

**4. Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University Bethlehem, PA, November 1993.**

Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS by Miller and Simmons of the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of  $H(n = 1/2)$  is 54.4 eV. Thus, the theoretical and measured binding energies for  $H(n = 1/2)$  are in excellent agreement. Lehigh University has conducted an extensive investigation of the cathodes from heat producing as well as those from control cells. Miller concludes that "I was unable to find any other elements on the surface that cause the feature. The persistent appearance of a spectral feature near the predicted binding energy for many of the electrodes used with a K electrolyte is an encouraging piece of evidence for the existence of the reduced energy state hydrogen".

**3. Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh

University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL). Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

**2. Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

**1. Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994.**

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

Given Applicant's full compliance with the newest standard imposed by Specialist McGinty during the February 11, 2003 Interview, which required independent validation of the experimental evidence of record, Applicant is entitled to have this evidence accepted as reliable and to have this and other BlackLight applications issue as patents.

**Applicant's Response Documenting Examiner Langel's Reaffirmation of the Utility and Operability of Applicant's Novel Hydrogen Technology and His Subsequent Removal From Examining All BlackLight Cases**

Pursuant to representations and agreements made during the February 11 Interview (reprinted below), Applicant followed up with the submission of much of the above scientific evidence in two copending BlackLight applications by arranging an Interview with Examiner Langel, who was assigned to those cases. [U.S. Serial Nos. 09/110,678 ('678 application) and 09/362,693 ('693 application).] The express purpose



of the Interview, held on April 14, 2003, was to review those two applications on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims. Examiner Langel expressed once again his view that the claims of the two applications were adequately supported by the data and, therefore, his willingness to allow those applications.

A detailed account of the discussions Applicant's counsel, Jeffrey Melcher and Jeffrey Simenauer, had with Examiner Langel during the April 14, 2003 Interview, and with Examiner Langel and his supervisor, SPE Stanley Silverman, during follow-up telephone Interviews were documented in Supplemental Responses filed in the '678 and '693 applications, comments from which are reproduced below. Based on the shocking revelations divulged during these discussions, Applicant must once again protest in the strongest terms possible the manner in which an anonymous group of PTO officials (*i.e.*, the "Secret Committee") has mishandled the examination of BlackLight's patent applications relating to Applicant's novel hydrogen technology.

Counsel was particularly distressed to learn that, after Examiner Langel met with Supervisor Silverman to advocate allowing the '678 and '693 applications to issue as patents, his supervisor informed him that "allowance is not an option." Despite the Examiner's careful study of the overwhelming weight of the scientific data supporting allowance, his supervisor further instructed him to "make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Understandably, Examiner Langel felt uneasy having been asked to make representations on the record that were not true. He explained that, "for moral and ethical reasons," he had no choice but to allow himself to be removed from examining all assigned BlackLight applications. Although Supervisor Silverman admitted that the removal decision had been made "partially by [him] and partially by others," he would not reveal who those "others" were.

Applicant strongly objects to Examiner Langel's removal under these egregious circumstances and demands that the PTO reinstate him immediately and allow BlackLight's applications to issue. The Secret Committee is duty bound to honor the representations and agreements made by Quality Assurance Specialist Douglas McGinty during the February 11, 2003 Interview, declaring that:

- (1) Examiner Langel and the other Examiners of record have "full authority" to review the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties and, based on that review, to issue patents as deemed appropriate;
- (2) Applicant should confer with the Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the claims; and
- (3) for those claims determined to be adequately supported by the data, a patent will issue; for any claims deemed to be inadequately supported, Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings. [See March 6, 2003 Response filed in the '678 application]

It was precisely because of the many prior abuses that led to this short-lived "breakthrough" that U.S. Congressman David Wu sent his Senior Legislative Assistant, Ted Liu, to attend the February 11 Interview. Prior to the Interview, a senior PTO official alleged to Mr. Liu that there was no "Secret Committee." At the Interview, Mr. Liu witnessed not only Specialist McGinty's representation that Examiner Langel had the authority to allow BlackLight's applications, but the Examiner's unequivocal statement that the applications were, in fact, allowable and that he was prepared to issue Applicant his patents right then and there. [See supra and Attachment P]

Despite those representations, an anonymous group of individuals has now declared that allowance is not even an option in BlackLight's cases. Worse yet, this Secret Committee wants to leave the false impression on the record that Examiner Langel—and perhaps other Examiners of record too—has the authority to allow BlackLight's applications, but that he favors the rejection of claims over allowance.

In view of this unfortunate incident, Applicant is entitled to a complete accounting of events leading to Examiner Langel's removal, including identification of all persons involved in making that decision. In raising an objection to the removal with Supervisor Silverman, Applicant's counsel requested that he identify those decision-makers, but was told, "You figure it out!"

### **Detailed Account of the April 14, 2003 Interview and Subsequent Discussions**

As stated above, the express purpose of the April 14, 2003 Interview was to review the scientific data generated and furnished by independent third parties identified in the March 6, 2003 Response that was filed in the '678 and '693 applications as supporting lower energy states of hydrogen and to ensure that the data adequately supported the scope of the claims to secure their allowance.

Applicant had no reason to suspect that this approach, as agreed to during the prior February 11, 2003 Interview, was about to be completely scrapped. During the subsequent April 14, 2003 Interview, Examiner Langel once again reaffirmed his long-held opinion that the scientific data demonstrated the operability of Applicant's novel hydrogen technology, thus warranting patent protection. The Examiner's comments made clear that, prior to the interview, he had extensively reviewed Applicant's data, as well as the summary statements characterizing that data, appearing in the prior Responses filed in the '678 and '693 applications. Based on that review, Examiner Langel expressed several times during the Interview his willingness to allow those cases. Those views were confirmed by the Examiner in his interview summary, which stated that "[t]he participants presented data establishing the existence of lower-energy hydrogen." [See April 14, 2003 Interview Summary Form filed in the '678 and '693 applications (Attachment F).]

Examiner Langel, however, refrained from indicating allowance of any specific claims for two stated reasons. First, a few items of submitted data summarized in the March 6 Response inexplicably could not be located in the PTO files. The Examiner wanted time to confirm the data had been made of record and Applicant's description of its relevance. Second, despite Specialist McGinty's representation at the February 11 Interview that Examiner Langel had full authority to review the data and to issue claims in this case, the Examiner explained that he needed to advise him and Supervisor Silverman of his intention to do so.

Examiner Langel then recalled a recent visit to his office by Group Director Jacqueline Stone informing him—again, contrary to what Applicant was told at the February 11, 2003 Interview—that he did not have authority to issue Notices of

Allowance, or to otherwise give indications of allowance, in any BlackLight applications. Director Stone instructed Examiner Langel that he would need Specialist McGinty's permission before so indicating allowance.

Examiner Langel did, however, note that Supervisor Silverman and Specialist McGinty had agreed before the February 11 Interview to allow claims if Applicant could show that his submitted scientific data was generated by independent third parties. The Examiner reassured counsel that he would present to his superiors the scientific data discussed at the April 14 Interview with a recommendation of allowance consistent with his past views.

Applicant's counsel agreed that it made sense to allow time for Examiner Langel to discuss the case with his superiors and for counsel to resubmit the few missing items of scientific data, whereupon arrangement was made to continue with the personal Interview on the following day, April 15<sup>th</sup>. That morning, however, counsel received a distressing telephone message from Examiner Langel informing him that the Interview had been canceled. The Examiner stated that Supervisor Silverman had removed him from the subject cases and that he was no longer assigned to any BlackLight applications.

Applicant's counsel immediately telephoned Examiner Langel for a further explanation of what had happened. The Examiner confirmed his removal following the meeting he had arranged with Supervisor Silverman to discuss the scientific data that had been the subject of the previous day's Interview and to advocate allowance of the claims in the two subject applications. Examiner Langel informed counsel that his supervisor refused to even look at the data and, in response to his recommendation of allowance, Supervisor Silverman told him "allowance is not an option." According to Examiner Langel he was then told: "make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Examiner Langel explained that, regrettably, he had no choice but to resign from further examination of BlackLight's applications. According to the Examiner, Supervisor Silverman gave him the option of staying on, "but not really—I could not go on like this." He explained that "for moral and ethical reasons," he could no longer continue to examine his assigned cases.

Alarmed by this sudden turn of events, counsel called Supervisor Silverman the following day, April 16<sup>th</sup>, to object to Examiner Langel's removal and to seek his reinstatement. Supervisor Silverman confirmed that Examiner Langel would no longer be examining Blacklight's patent applications and that all cases were in the process of being consolidated and transferred to a new Examiner.

Counsel kindly requested that Supervisor Silverman explain why those cases were being transferred and who made that decision. He initially refused to discuss the matter, saying only that, "I am not going to be put on the stand and cross examined on this." Upon further prodding, Supervisor Silverman volunteered that "the decision was made partially by me and partially by others." He refused, however, to be more specific when asked to identify the "others" involved in the decision, stating "I am not going to discuss that. You can say that it was *my* decision."

Counsel then informed Supervisor Silverman of Applicant's intention to file the present objection to Examiner Langel's removal and to the consolidation and transfer of BlackLight's applications to a new Examiner. Counsel explained that Applicant had expended enormous amounts of time and money over a period of many years prosecuting BlackLight's patent applications before Examiner Langel and getting him up to speed on the claimed technology and the extensive scientific data confirming its operation. Counsel argued that it was unfair now to remove Examiner Langel and transfer all of BlackLight's cases to a new Examiner just to begin the process all over again. Supervisor Silverman would hear none of it, again stating, "I'm not going to discuss it."

Applicant's counsel made one last attempt to learn the identity of the other PTO officials responsible for taking that drastic action and their reasons for doing so. Supervisor Silverman again refused this request for information, snapping at counsel, "You figure it out!" Counsel then asked the Supervisor whom they might talk to so they could "figure it out" as he put it. Supervisor Silverman advised counsel, "Talk to whomever you want," but when asked whom specifically he had in mind, he again retorted, "I don't like to be cross-examined."<sup>106</sup>

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<sup>106</sup> Counsel has taken steps "to figure it out" and expressly reserves the right to further supplement the objections raised herein as additional facts come to light. (Attachment R)

At the end of the conversation, Supervisor Silverman attempted to justify the PTO's extreme actions by claiming that it was in the "best interest" to transfer the applications. But, when asked by counsel whose best interest was being served by the transfer, he refused to answer. Instead, Supervisor Silverman offered a stunning revelation that Applicant's novel hydrogen technology was "beyond Examiner Langel's technical expertise" and that all of the BlackLight cases would be consolidated and transferred to another examiner with "more technical expertise." He would not elaborate on who this new, more highly qualified Examiner might be.<sup>107</sup>

Needless to say, at no time during the five years Applicant has been prosecuting his patent applications before Examiner Langel—who has over thirty years of Patent Office experience—did his technical expertise ever come into question. Indeed, throughout this lengthy prosecution, counsel has been impressed with the Examiner's in-depth knowledge of chemistry and physics, as well as other scientific principles, underlying Applicant's novel hydrogen technology. That Supervisor Silverman would now raise Examiner Langel's technical competence as an issue at this late stage of the prosecution only heightens Applicant's suspicions as to the real motivation for removing Examiner Langel.

Immediately following the conversation with Supervisor Silverman, counsel telephoned Examiner Langel one last time to apprise him of the situation and to thank him for his many years of service in examining BlackLight's applications. Examiner Langel expressed regret over his removal from those cases and confirmed that he had "learned a lot about [BlackLight's] technology." The Examiner also expressed surprise that his expertise was now being called into question.

Examiner Langel shared counsel's exasperation over the situation. Counsel asked him if he knew of any other instances in which a PTO Examiner had been instructed to represent that he had authority to allow an application when, in fact, he had

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<sup>107</sup> Supervisor Silverman's statement that all of BlackLight's applications were being consolidated and transferred to a single more qualified Examiner turned out to be untrue. In fact, Applicant's cases have been spread between Examiner Kalafut and a new Examiner, Susie N. Tsang-Foster, and two of Applicant's cases remain assigned to Examiners Wells and Wayner, for a total of four present Examiners, not one.

no such authority, and that he favored rejecting claims when he actually wanted to allow them. The Examiner's exact words were: "I've never seen anything like it."

Finally, neither has Applicant's counsel and, in view of these unique circumstances, Applicant must once again strenuously object to the abusive treatment to which his applications have been subjected.

### **Demand for Information and Redress**

Applicant believes that the totality of events documented above are highly relevant to the PTO's examination of all of BlackLight's patent applications and document the detrimental effects that examination has had on Applicant's patent rights. These events further demonstrate the PTO's failure to provide adequate safeguards to the interests of Applicant, including fair and expeditious examination, as contemplated by the Federal Circuit in its June 28, 2002 Decision. Applicant therefore respectfully demands that the Secret Committee provide certain information and redress, including:

- 1) identification of all Examiners or other PTO personnel who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 2) identification of all outside consultants or other persons who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 3) identification of all PTO officials responsible for withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding that withdrawal action;
- 4) identification of all outside sources of information who may have precipitated, or otherwise contributed to, the PTO withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding those actions;
- 5) a complete disclosure of the facts and circumstances surrounding the removal of Examiner Langel from examining BlackLight's applications and the transfer those cases to a new Examiner, including, but not limited to, identification of all persons involved these incidents;

- 6) immediate reinstatement of Examiner Langel to his position as the Examiner of record in all BlackLight applications to which he had been previously assigned;
- 7) the examination and issuance of all allowable BlackLight applications in accordance with the representations and agreements made at the February 11, 2003 Interview; and
- 8) as a matter of equity, the immediate issuance, without further examination, of all five of BlackLight's withdrawn patent applications due to the PTO's failure to provide the safeguards to the interests of Applicant, including fair and expeditious further examination as contemplated by the Federal Circuit in its June 28, 2002 Decision.

**Response to Specific Arguments Presented in  
the Secret Committee's Most Recent Office Action**

Applicant reached agreements with the PTO during the February 11, 2003 Interview as to how it would conduct its examination of BlackLight's applications following the tumultuous prosecution history of these cases. The Secret Committee, in its subsequent Office Actions, including the present one, now defaults on those agreements, whereby examination in this case has reverted back to where Applicant's scientific evidence is almost entirely ignored on baseless theoretical grounds without applying reasonable patent standards, confirming that "allowance is not an option." Despite the unfairness of these actions, Applicant will not be deterred from seeking the patent rights to which he is entitled.

With that said, Applicant now addresses the Committee's latest arguments presented in the pending Office Action:



Applicant is stunned that the Secret Committee ignored all of Applicant's arguments filed in his previous response and simply mails the same identical attachment in the present Office Action. All of the arguments in that attachment have already been addressed in Applicant's previous response and appendix. Applicant repeats those same arguments in the appendix to this response and requests that the Committee fully consider those arguments.

### **Applicant's Lower-Energy Hydrogen Complies With all Laws of Chemistry and Physics**

On page 3 of the Office Action, the Secret Committee argues that "Applicant's invention is based on the existence of the hydrino atom which is contrary to the known laws and theories of chemistry and physics."

Applicant requests that the Committee provide a legitimate basis, complete with full explanation, for any alleged inaccuracies in Applicant's extensive theories, in place of vague remarks about impossibilities and incredibilities, so that Applicant is afforded the opportunity to provide an adequate response. Mere conclusions by the Committee that ambiguous physics and chemistry laws and theories are broken is contrary to patent laws and impose impossible barriers to allowance. Indeed, as discussed fully above, Applicant's theory fully complies with the laws of chemistry and physics, including the laws of thermodynamics and Maxwell's Equations.

On page 4 of the Office Action the Committee argues that:

Applicant's theory of the hydrino atom predicts a new form of the hydrogen atom having energy states represented by fractional quantum numbers that are below the conventional ground state of the hydrogen atom. These energy states having fractional quantum numbers are contrary to the conventionally accepted energy states of the hydrogen atom having positive integer quantum numbers predicted by quantum mechanics that have been successfully verified by decades of independent, invention.

A full response to the Committee's argument is provided in the Appendix attached to this response.

**Applicant has Provided 47 Studies Disclosing  
Independent Experimental Evidence Supporting  
the Existence of Lower-Energy Hydrogen (Hydrino)**

On page 4 of the Office Action, the Committee erroneously argues that:

In contrast to applicant's assertions filed on 3/10/2003 that the 45 studies are independent, these studies appear to be collaborations or applicant's own work as evidenced by investigator J. Phillip's title "visiting researcher at BlackLight Power" in some of the abstracts and applicant's direct participation in these studies. For example, as seen in abstracts #4, #7, #16, and #20 through #43, R. Mills who is an applicant of the instant application is one of the investigators or only investigator of these studies. Thus, at least 27 of the 45 studies are applicant's own work. It is also noted that a vast majority of the 45 studies submitted to journals have not been peer reviewed or accepted for journal publication.

Applicant provides herein above a complete list of 47 abstracts containing underlined reference to the independent party that generated the experimental data. Applicant now has over 50 journal articles that have completed the peer-review process, including Reference Nos. 1-34, 37-38, 40-43, 45-52, 54, 56-57, 59-61, 63, 67, 69, and 90. A complete list of all References is shown below. Applicant expects many more of his submitted journal articles to also complete the peer-review process and be published despite efforts by Dr. Zimmerman to prevent such publication.

The list of journals where Applicant's articles have been published is impressive:

Applied Physics Letters  
Chemistry of Materials  
Electrochimica Acta  
European Physical Journal: Applied Physics  
Fusion Technology  
IEEE Transactions on Plasma Science  
International Journal of Hydrogen Energy  
Journal of Applied Physics  
Journal of Material Science  
Journal of Molecular Structure

Journal of Optical Materials  
Journal of Plasma Physics  
Journal of Physics D: Applied Physics  
Journal of Quantitative Spectroscopy and Radiative Transfer  
Journal of New Materials for Electrochemical Systems  
New Journal of Physics  
Physics Essays  
Plasma Sources Science and Technology  
Solar Energy Materials & Solar Cells  
Thermochimica Acta  
Vibrational Spectroscopy

The list of journals where Applicant's articles have been submitted and are being reviewed is also impressive:

Acta Physica Polonica A  
AIAA Journal  
Annales de la Fondation Louis de Broglie  
Canadian Journal of Physics  
Contributions to Plasma Physics  
Current Applied Physics  
Doklady Chemistry  
European Journal of Physics D  
Europhysics Letters  
Fizika A  
Foundations of Physics  
Japanese Journal of Applied Physics  
Journal of Applied Spectroscopy  
Journal of Materials Research  
Journal of Physical Chemistry A  
Journal of Physical Chemistry B  
Journal of Physics B

Journal of Plasma Physics  
Journal of the Physical Society of Japan  
Journal of Vacuum Science & Technology A  
Low Temperature Physics  
Materials Characterization  
Materials of Science and Engineering B  
Thin Solid Films  
Vacuum

**The Committee has Not Provided Substantial Evidence  
That the Hydrino Atom Does Not Theoretically Or Physically Exist**

On page 4 of the Office Action, the Committee erroneously argues that it “has already provided substantial evidence that the hydrino atom does not theoretically or physically exist as presently claimed and thus those skilled in the art would ‘reasonably doubt’ the asserted utility and operability of applicant’s invention.”

Applicant submits that the Committee has not provided any cogent reasoning or experimental evidence refuting the existing of the hydrino atom, other than allegations that the hydrino atom is contrary to unnamed laws and theories.

In contrast, Applicant provided a valid theory based on first principles that predicted the hydrino atom and then Applicant proceeded to produce the hydrino atom based on that theory. Applicant now has over 100 articles and books of record in this case, as reflected in the “List of References” set forth below.<sup>1</sup> These articles detail studies that experimentally confirm a novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional “ground” ( $n = 1$ ) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds, including:

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<sup>1</sup> While the articles and books numbered 1-70 were already made of record in previous submissions, many of those articles have now been published. Therefore, Applicant submits herewith copies of articles 50-101.

extreme ultraviolet (EUV) spectroscopy<sup>2</sup>,  
characteristic emission from catalysis and the hydride ion products<sup>3</sup>,  
lower-energy hydrogen emission<sup>4</sup>,  
plasma formation<sup>5</sup>,  
Balmer  $\alpha$  line broadening<sup>6</sup>,  
population inversion of hydrogen lines<sup>7</sup>,  
elevated electron temperature<sup>8</sup>,  
anomalous plasma afterglow duration<sup>9</sup>,  
power generation<sup>10</sup>, excessive light emission<sup>11</sup>, and  
analysis of chemical compounds<sup>12</sup>.

The Committee simply ignores this real-world experimental data and relies instead upon mere conclusions that the hydrino atom cannot exist. Applicant requests that the Committee fully consider this vast experimental data.

### **Applicant's Theory is Mathematically Correct and Physically Sound**

On page 5 of the Office Action, the Committee erroneously argues that "applicant's theory is contradictory, physically unsound, and mathematically incorrect." Applicant provides a full response to this argument in the attached Appendix. Applicant's theory is based on fundamental scientific law, i.e. Maxwell's equations. The fact that the theory predicted the existence of hydrino

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<sup>2</sup> Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76,

78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98

<sup>3</sup> Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91

<sup>4</sup> Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98

<sup>5</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93

<sup>6</sup> Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91,

92, 93, 95-97

<sup>7</sup> Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91

<sup>8</sup> Reference Nos. 34-37, 43, 49, 63, 67, 73

<sup>9</sup> Reference Nos. 12-13, 47, 81

<sup>10</sup> Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98

<sup>11</sup> Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72

<sup>12</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100

atom and that Applicant actually produced such hydrino atom, is proof that Applicant's theory is consistent, mathematically correct, and physically sound.

**Applicant's Theory is Not the Only Source  
From Which the Existence of Hydrino Atom is Demonstrated**

On page 5 of the Office Action, the Committee argues that "applicant's theory is the *unique* source from which the existence of the 'hydrino atom' is demonstrated."

Applicant's theory predicted the existence of the hydrino atom. That theory is not the end-all means by which scientists can verify the actual existence of hydrino atoms, which have now been actually produced by Applicant. As discussed above, the hydrino atom can be verified as hydrogen having an electron in a lower-energy state by the following means:

extreme ultraviolet (EUV) spectroscopy<sup>13</sup>,  
characteristic emission from catalysis and the hydride ion products<sup>14</sup>,  
lower-energy hydrogen emission<sup>15</sup>,  
plasma formation<sup>16</sup>,  
Balmer  $\alpha$  line broadening<sup>17</sup>,  
population inversion of hydrogen lines<sup>18</sup>,  
elevated electron temperature<sup>19</sup>,  
anomalous plasma afterglow duration<sup>20</sup>,  
power generation<sup>21</sup>,  
excessive light emission<sup>22</sup>, and  
analysis of chemical compounds<sup>23</sup>.

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<sup>13</sup> Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98

<sup>14</sup> Reference Nos. 24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91

<sup>15</sup> Reference Nos. 14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98

<sup>16</sup> Reference Nos. 11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93

<sup>17</sup> Reference Nos. 16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97

<sup>18</sup> Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91

<sup>19</sup> Reference Nos. 34-37, 43, 49, 63, 67, 73

<sup>20</sup> Reference Nos. 12-13, 47, 81

<sup>21</sup> Reference Nos. 30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98

<sup>22</sup> Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72

<sup>23</sup> Reference Nos. 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98,

The Committee cannot use Applicant's theory as a basis to ignore this real-world evidence showing the existence of man-made hydrino atoms, which evidence is based upon laboratory experiments, not mere theory.

### **Newman's Machine is Irrelevant to the Present Invention**

On page 5 of the Office Action, the Committee argues that:

Moreover, a similar interpretation of an invention occurred in *Newman v Quigg, op. cit.*, where an applicant's claims to a machine which operated according to a theory which violated the second law of thermodynamics were held to be unpatentable. Hence it is clear why the examiner is obliged to review applicant's theory in addition to evaluating the experimental evidence alleged to support patentability of the present claims.

While Newman's machine violated an actual, identifiable scientific law, the second law of thermodynamics, Applicant's hydrino atom, by contrast, is fully consistent with all laws of physics and chemistry. Indeed, the Committee has failed to identify a single law that is violated by Applicant's novel hydrogen chemistry—because it cannot.

In summary, Applicant's invention is a novel method of extracting energy from hydrogen atoms using a catalytic process to form hydrino atoms having an electron in a lower-energy state. The energy is produced as a result of the hydrogen electron going to a lower-energy state. Thus, the present invention distinguished over Newman's machine and all references to and comparisons with Newman should be withdrawn.

### **The Committee Has Failed to Fairly Evaluate Applicant's Experimental Evidence Confirming the Formation of Lower-Energy Hydrogen**

On pages 5-6 of the Office Action, the Committee states that it has shown "applicant's theory of the hydrino atom to be incorrect and the lack of independent, reproducible experiments that verify the existence of the hydrino atom, applicant has as failed to provide preponderance of evidence to support

his claims.” This statement is simply false. As discussed herein above, Applicant has provided extensive independent experimental evidence to support the existence of the hydrino atom.

What little experimental evidence the Committee does address in its Final Rejection—for the first time in most cases—does not receive even a minimum of fair consideration. Rather, the Committee continually mischaracterizes that evidence, or strains to find other unjustifiable excuses, so as to diminish its significance.

Such blatant disregard for Applicant’s experimental evidence, costing tens of millions of dollars to produce, merely demonstrates a continuation of the hostility that has been directed towards Applicant. Applicant nonetheless responds in good faith to the Secret Committee’s unfounded criticisms as articulated in the numbered paragraphs of the Attachment that accompanied its present Office Action.

**Applicant's response to the Committee's contention that "19. The Turner and Dhandapani Declarations with respect to NMR experimental data lack probative value"**

Among the few items of evidence addressed by the Committee are the Turner and Dhandapani Declarations submitted in support of the NMR data. The Committee argues that those Declarations lack probative value, but only by distorting the statements presented therein.

For instance, regarding Dr. Turner’s Declaration, the Committee focuses on a single paragraph (No. 8), noting his statement that, in his many years of conducting NMR scans, he had “never observed signals in the region of  $-4$  to  $-5$  ppm before.” The Committee then dismisses the Declaration in its entirety based on nonsensical argument that “upfield shifts in the region from  $-4$  to  $-5$  ppm are known in the prior art.”

The Committee must realize, however, that Dr. Turner was referring to alkali hydrides, not  $\beta - Mg_2NiH_4$ . Dr. Turner communicated to Applicant at the time of the initial NMR studies that metal hydrides, such as transition metal and



noble metal hydrides complexes, may have upfield-shifted peaks, but no saline-like—alkali or alkaline earth metal hydrides—have been reported to have such shifts. Nor, had he observed any such shifts in these class of compounds in his twenty or so years of NMR experience.

Dr. Turner also ran the corresponding ordinary alkali and alkaline earth hydrides alone and mixed with the corresponding alkali or alkaline earth halide—no upfield peaks were observed. Only the known peaks of the alkali hydride were observed.

Regarding Dr. Dhandapani's Declaration, the Committee seizes on a single word in dismissing it because it concludes "with a tentative suggestion that a 'hydrino hydride ion' may exist." Once again, the Committee's strained reasoning for refusing to seriously consider Applicant's experimental evidence merely reflects its biased approach that seeks to deny him a patent regardless of what the evidence shows.

Since no other explanation existed for the upfield-shifted NMR peaks of the alkali and alkaline earth hydrides and halido hydrides that were reproduced at five major independent laboratories, the compounds must have contained novel hydrides ions. Thus, they "may" be hydrino hydrides. This is the standard conservative approach of reporting a new finding adhered to by Dr. Dhandapani.

Furthermore, the recent spectroscopic data set forth in this Response absolutely confirms that the novel hydride ions are hydrino hydride ions with binding energies given in Table 1 of the Specification.

The Committee's further comment that the Declarants did not establish that "a host of other species, including contaminants, could not have contributed to such signals rather than the alleged 'hydrino hydride' compounds" is absurd on its face. Contaminants were considered in the assignment of the upfield-shifted peaks. NMR is only responsive to protons. The contaminants present, as identified by ToF-SIMS, were trace amounts of hydroxide, other halide ions, and

other alkali or alkaline earth ions. These ToF-SIMS results were provided to the Committee.<sup>24</sup>

None of the alkaline or alkaline earth hydrides produced upfield-shifted peaks alone, or in combination with, halides or hydroxide ions. The NMR peak of the latter was observed at about +4 ppm. The threshold for detection of protons by NMR is about 1% of the sample volume, an unreasonable amount based on the purity of the starting materials and the analysis of the product by ToF-SIMS and XPS. The Committee has presented no prior art that the reported compounds, alkaline and alkaline earth hydrides and halido hydrides have upfield-shifted NMR peaks.

The NMR tests were replicated at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada.<sup>25</sup> None of these laboratories reported known alkali or alkaline earth hydrides or halido hydrides with upfield-shifted NMR peaks. The assignment was confirmed by the recent NMR identification of novel hydride compounds  $MH^*$  and  $MH_2^*$  wherein  $M$  is the alkali or alkaline earth metal and  $H^*$  comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition.

Furthermore, a number of recent additional tests were performed which unequivocally establish the identification of novel hydrides. The results summarized in this Response absolutely identify the emission of the novel hydride ions, the characteristic emission from the catalysts, and the novel hydride compounds. For example:

The hydride ions formed during the catalysis reaction were identified by high-resolution spectroscopy. For example, the catalyst product of  $Rb^+$  and two  $K^+$ ,  $H(1/2)$ , was predicted to be a highly reactive intermediate which further

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<sup>24</sup> References 40 and 42.

<sup>25</sup> Reference 20.

reacts to form a novel hydride ion  $H^-(1/2)$ . This hydride ion with a predicted binding energy of  $3.0468\text{ eV}$  was observed by high-resolution visible spectroscopy as a broad peak at  $4070.0\text{ \AA}$  with a FWHM of  $1.4\text{ \AA}$ . From the electron  $g$  factor, bound-free hyperfine structure lines of  $H^-(1/2)$  were predicted with energies  $E_{HF}$  given by  $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575\text{ eV}$  ( $j$  is an integer) as an inverse Rydberg-type series that converges at increasing wavelengths and terminates at  $3.0575\text{ eV}$ —the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission spectra in the region of  $4000\text{ \AA}$  to  $4060\text{ \AA}$  matched the predicted emission lines for  $j = 1$  to  $j = 37$  to 1 part in  $10^5$ .<sup>26</sup>

The dominant  $H^-$  in the negative ion ToF-SIMS spectra confirm the claimed novel hydride compounds.<sup>27</sup>

The core level shifts of the alkali or alkaline earth metal due to the binding of the hydrino hydride ion confirm the claimed alkali and alkaline earth hydrides and halido hydrides.<sup>28</sup>

The hydrino hydride binding energies observed by XPS confirm the claimed compounds.<sup>29</sup>

The novel peaks observed by liquid chromatography/mass spectroscopy confirm the claimed compound  $KHI$ .<sup>30</sup>

Large heats of formation confirm the claimed compound  $KHI$ .<sup>31</sup>

Unable to offer its own rational explanation for Applicant's astounding NMR data and other submitted evidence, the Committee resorts to distortions

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<sup>26</sup> References 2 and 7.

<sup>27</sup> References 3, 4, 40, 42, and 43.

<sup>28</sup> References 40 and 42.

<sup>29</sup> References 3, 4, 40, 41, 42, and 43.

<sup>30</sup> Reference 40.

<sup>31</sup> Reference 24.

and other obfuscations to reject the obvious conclusion that must be drawn from that evidence—that fractional quantum states of hydrogen do indeed exist.

**Applicant's response to the Committee's contention that "24. Applicant's spectroscopic and plasma experimental data are not persuasive"**

The Committee's unfounded criticism of Applicant's experimental evidence continues with its dismissal of Applicant's spectroscopic and plasma data as being unpersuasive. And, once again, Applicant dismantles those criticisms in exposing the Committee's weak position.

As an initial matter, Applicant notes that the skepticism on the part of STC experts regarded whether a 55 eV peak observed in the low binding energy region of the XPS spectrum of the high purity nickel cathode was a predicted hydrino peak or whether the peak was due to iron. The survey scan, which was not given to the STC experts until a later date, showed no iron peaks. It was later confirmed by ToF-SIMS that iron could not be the source of the novel peak observed.<sup>32</sup>

The Committee is mistaken as to what is identified in figure 17, for example. The identified hydride ion  $H^-(1/p)$  peaks correspond to their predicted binding energies, which are given in Table 1 of the Application. They do not correspond to transitions between different orbitals or energy levels.

Furthermore, the peaks should have low intensity since the cross-section for the ionizing X-rays is proportional to the radius of the atom squared, and the radius of the hydrino hydride ions are much smaller than the radii of the other elements present such as potassium. Extensive data which confirm hydrino hydride ions by XPS is summarized in this Response.

On page 3, line 31 through page 4, line 5 of the present specification, Applicant discloses:

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<sup>32</sup> Reference 82.

This invention is directed to a new composition of matter comprising a hydride ion ( $H^-$ ) having a binding energy greater than  $0.8 \text{ eV}$ , as reflected in the following formula

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi\mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left( 1 + \frac{2^2}{\left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right) \quad (1)$$

where  $p$  is an integer greater than one,  $s = 1/2$ ,  $\pi$  is pi,  $\hbar$  is Planck's constant bar,  $\mu_0$  is the permeability of vacuum,  $m_e$  is the mass of the electron,  $\mu_e$  is the reduced electron mass,  $a_0$  is the Bohr radius, and  $e$  is the elementary charge.

From page 6, lines 1-25 of the present specification, Applicant discloses:

TABLE 1. The representative binding energy of the hydrino hydride ion  $H^-(n = 1/p)$  as a function of  $p$ , Eq. (1).

Hydride Ion	$r_1$ ( $a_0$ ) <sup>a</sup>	Binding Energy <sup>b</sup> (eV)	Wavelength (nm)
$H^-(n = 1/2)$	0.9330	3.047	407
$H^-(n = 1/3)$	0.6220	6.610	188
$H^-(n = 1/4)$	0.4665	11.23	110
$H^-(n = 1/5)$	0.3732	16.70	74.2
$H^-(n = 1/6)$	0.3110	22.81	54.4
$H^-(n = 1/7)$	0.2666	29.34	42.3
$H^-(n = 1/8)$	0.2333	36.08	34.4
$H^-(n = 1/9)$	0.2073	42.83	28.9
$H^-(n = 1/10)$	0.1866	49.37	25.1
$H^-(n = 1/11)$	0.1696	55.49	22.3
$H^-(n = 1/12)$	0.1555	60.97	20.3
$H^-(n = 1/13)$	0.1435	65.62	18.9
$H^-(n = 1/14)$	0.1333	69.21	17.9
$H^-(n = 1/15)$	0.1244	71.53	17.3
$H^-(n = 1/16)$	0.1166	72.38	17.1

<sup>a</sup> Equation (21), *infra*.

<sup>b</sup> Equation (22), *infra*.

These hydride ions are now identified definitively by XPS data and additional methods such as high-resolution visible spectroscopy as summarized herein.

For example, the catalyst product of  $Rb^+$  and two  $K^+$ ,  $H(1/2)$ , was predicted to be a highly reactive intermediate which further reacts to form a novel hydride ion  $H^-(1/2)$ . This hydride ion with a predicted binding energy of 3.0468 eV was observed by high-resolution visible spectroscopy as a broad peak at 4070.0 Å with a FWHM of 1.4 Å. From the electron  $g$  factor, bound-free hyperfine structure lines of  $H^-(1/2)$  were predicted with energies  $E_{HF}$  given by  $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575 \text{ eV}$  ( $j$  is an integer) as an inverse Rydberg-type series that converges at increasing

wavelengths and terminates at  $3.0575\text{ eV}$ —the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission spectra in the region of  $4000\text{ Å}$  to  $4060\text{ Å}$  matched the predicted emission lines for  $j = 1$  to  $j = 37$  to 1 part in  $10^5$ .<sup>33</sup>

The Committee's position that Applicant's plasma, which forms at 2 V, cannot be due to energy tapped off from lower-energy hydrogen formation is based on the false premise that Applicant has not shown lower-energy hydrogen production. Applicant, however, has in fact demonstrated that electrons with fractional quantum numbers do exist.<sup>34</sup>

Studies that experimentally confirm the disclosed novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ( $n = 1$ ) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds are described in detail in this Response. A brief summary includes:

- extreme ultraviolet (EUV) spectroscopy,
- characteristic emission from catalysis and the hydride ion products,
- lower-energy hydrogen emission,
- plasma formation,
- Balmer  $\alpha$  line broadening,
- elevated electron temperature,
- anomalous plasma afterglow duration,
- power generation, and
- analysis of chemical compounds.

To assist the Committee in understanding the novel catalytic reaction of atomic hydrogen of the present invention, an excerpt from R. L. Mills, P. Ray,

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<sup>33</sup> Reference 2 and 7.

<sup>34</sup> Reference 32.

"High Resolution Spectroscopic Observation of the Bound-Free Hyperfine Levels of a Novel Hydride Ion Corresponding to a Fractional Rydberg State of Atomic Hydrogen", *Int. J. Hydrogen Energy*, in press, is provided:

## I. INTRODUCTION

### A. Background

J. J. Balmer showed in 1885 that the frequencies for some of the lines observed in the emission spectrum of atomic hydrogen could be expressed with a completely empirical relationship. This approach was later extended by J. R. Rydberg, who showed that all of the spectral lines of atomic hydrogen were given by the equation:

$$\bar{\nu} = R \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (1)$$

where  $R = 109,677 \text{ cm}^{-1}$ ,  $n_f = 1, 2, 3, \dots$ ,  $n_i = 2, 3, 4, \dots$ , and  $n_i > n_f$ .

Niels Bohr, in 1913, developed a theory for atomic hydrogen that gave the energy levels in agreement with Rydberg's equation. An identical equation, based on a totally different theory for the hydrogen atom, was developed by E. Schrodinger, and independently by W. Heisenberg, in 1926.

$$E_n = -\frac{e^2}{n^2 8 \pi \epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

where  $a_H$  is the Bohr radius for the hydrogen atom ( $52.947 \text{ pm}$ ),  $e$  is the magnitude of the charge of the electron, and  $\epsilon_0$  is the vacuum permittivity.

The excited energy states of atomic hydrogen are given by Eq. (2a) for  $n > 1$  in Eq. (2b). The  $n = 1$  state is the "ground" state for "pure" photon transitions (the  $n = 1$  state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a nonradiative energy transfer such as multipole



coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [1]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [2].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen,  $m \cdot 27.2 \text{ eV}$  wherein  $m$  is an integer. The theory and supporting data was given previously [3-37]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen called a *hydrino* that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (2c)$$

replaces the well-known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states. The  $n = 1$  state of hydrogen and the  $n = \frac{1}{\text{integer}}$  states of hydrogen are nonradiative, but a

transition between two nonradiative states is possible via a nonradiative energy transfer, say  $n = 1$  to  $n = 1/2$ . In these cases, during the transition the electron couples to another electron transition, electron transfer reaction, or inelastic scattering reaction which can absorb the exact amount of energy that must be removed from the hydrogen atom to cause the transition. Thus, a catalyst provides a net positive enthalpy of reaction of  $m \cdot 27.2 \text{ eV}$  (i.e., it absorbs  $m \cdot 27.2 \text{ eV}$  where  $m$  is an integer). Certain atoms or ions serve as catalysts which resonantly accept the nonradiative energy transfer from hydrogen atoms and release the energy to the surroundings to affect electronic transitions to fractional quantum energy levels. As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

## B. rt-plasma

It was reported previously that a new plasma source has been developed that operates by incandescently heating a hydrogen dissociator to provide atomic hydrogen and heats a catalyst such that it becomes gaseous and reacts with the atomic hydrogen to produce a rt-plasma. It was extraordinary, that intense

EUV emission was observed by Mills et al. [11, 13-15, 23-24, 26-27] at low temperatures (e.g.  $\approx 10^3$  K) from atomic hydrogen and certain atomized elements or certain gaseous ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV that comprise catalysts. The only pure elements that were observed to emit EUV were those wherein the ionization of  $t$  electrons from an atom to a continuum energy level is such that the sum of the ionization energies of the  $t$  electrons is approximately

$$m \cdot 27.2 \text{ eV} \tag{3}$$

where  $t$  and  $m$  are each an integer. Alternatively, a catalyst depended on the transfer of  $t$  electrons between participating ions such that the transfer of  $t$  electrons from one ion to another ion provides a net enthalpy of reaction whereby the sum of the ionization energy of the electron donating ion minus the ionization energy of the electron accepting ion equals approximately  $m \cdot 27.2 \text{ eV}$ .

Since  $Ar^+$  and strontium each ionize at an integer multiple of the potential energy of atomic hydrogen, a discharge with one or more of these species present with hydrogen was anticipated to form a rt-plasma wherein the plasma forms by a resonance transfer mechanism involving the species providing a net enthalpy of a multiple of 27.2 eV and atomic hydrogen.

Mills and Nansteel [11, 16-17, 23] have reported that strontium atoms each ionize at an integer multiple of the potential energy of atomic hydrogen and caused emission. (The enthalpy of ionization of  $Sr$  to  $Sr^{5+}$  has a net enthalpy of reaction of 188.2 eV, which is equivalent to  $m = 7$ .) The emission intensity of the plasma generated by atomic strontium increased significantly with the introduction of argon gas only when  $Ar^+$  emission was observed. Whereas, no emission was observed when chemically similar atoms that do not ionize at integer multiples of the potential energy of atomic hydrogen (sodium, magnesium, or barium) replaced strontium with hydrogen, hydrogen-argon mixtures, or strontium alone.

Mills and Nansteel [16-17, 23] measured the power balance of a gas cell having vaporized strontium and atomized hydrogen from pure hydrogen or argon-hydrogen mixture (77/23%) by integrating the total light output corrected for spectrometer system response and energy over the visible range. Hydrogen control cell experiments were identical except that sodium, magnesium, or

barium replaced strontium. In the case of hydrogen-sodium, hydrogen-magnesium, and hydrogen-barium mixtures, 4000, 7000, and 6500 times the power of the hydrogen-strontium mixture was required, respectively, in order to achieve that same optically measured light output power. With the addition of argon to the hydrogen-strontium plasma, the power required to achieve that same optically measured light output power was reduced by a factor of about two. The power required to maintain a plasma of equivalent optical brightness with strontium atoms present was 8600 and 6300 times less than that required for argon-hydrogen and argon control, respectively. A plasma formed at a cell voltage of about 250 V for hydrogen alone and sodium-hydrogen mixtures, 140-150 V for hydrogen-magnesium and hydrogen-barium mixtures, 224 V for an argon-hydrogen mixture, and 190 V for argon alone; whereas, a plasma formed for hydrogen-strontium mixtures and argon-hydrogen-strontium mixtures at extremely low voltages of about 2 V and 6.6 V, respectively.

It was reported [15] that characteristic emission was observed from a continuum state of  $Ar^{2+}$  which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen  $Ar^+$ . The transfer of 27.2 eV from atomic hydrogen to  $Ar^+$  in the presence of a electric weak field resulted in its excitation to a continuum state. Then, the energy for the transition from essentially the  $Ar^{2+}$  state to the lowest state of  $Ar^+$  was predicted to give a broad continuum radiation in the region of 456 Å. This broad continuum emission was observed. This emission was dramatically different from that given by an argon microwave plasma wherein the entire Rydberg series of lines of  $Ar^+$  was observed with a discontinuity of the series at the limit of the ionization energy of  $Ar^+$  to  $Ar^{2+}$ . The observed  $Ar^+$  continuum in the region of 456 Å confirmed the rt-plasma mechanism of the excessively bright, extraordinarily low voltage discharge. The product hydride ion with  $Ar^+$  as a reactant was predicted to have a binding energy of 3.05 eV and was observed spectroscopically at 4070 Å [11, 15].

The catalysts mechanism has been confirmed spectroscopically for helium ion, rubidium ion, potassium atom and two potassium ions, argon ion, and cesium atom by the observation of the formation of the predicted oxidation states of the catalyst, which cannot be ordinarily explained under the operating conditions of the cell, by characteristic emission from the catalysts, and by

spectroscopic identification of lower-energy atomic, molecular ion, or hydride ions as summarized in this Response.

Strontium may serve as a catalyst since it can provide a net enthalpy of reaction of an integer multiple of that the potential energy of atomic hydrogen. The first through the fifth ionization energies of strontium are 5.69484 eV, 11.03013 eV, 42.89 eV, 57 eV, and 71.6 eV, respectively.<sup>35</sup> The ionization reaction of  $Sr$  to  $Sr^{5+}$ , ( $t = 5$ ), then, has a net enthalpy of reaction of 188.2 eV, which is equivalent to  $7 \cdot 27.2$  eV with in experimental error of the published ionization energies for strontium.

$$188.2 \text{ eV} + Sr(m) + H\left[\frac{a_H}{p}\right] \rightarrow Sr^{5+} + 5e^- + H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \text{ eV} \quad (6)$$

$$Sr^{5+} + 5e^- \rightarrow Sr(m) + 188.2 \text{ eV} \quad (7)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+7)}\right] + [(p+7)^2 - p^2]X13.6 \text{ eV} \quad (8)$$

The oxidation state in which strontium is commonly found in inorganic compounds is irrelevant to the present catalytic reaction since it only involves a resonance between atomic hydrogen and strontium without any regard to the formation of stable inorganic compounds such as strontium chloride.

The identification of  $Sr^{5+}$  is experimentally challenging due to required detection at very short wavelengths. The formation of a hydrogen plasma with atomic hydrogen and atomic strontium with no plasma from controls such as magnesium supports that Sr is acting as a catalyst since no conventional explanation of the data can be found. The Committee provides no prior art for the formation of a hydrogen plasma by heating strontium with atomic hydrogen or for the formation of a discharge at 2 V with strontium and hydrogen present.

The Committee further criticizes the experiments conducted at the Institut fur Niedertemperatur-Plasmaphysik e.V. by Dr. Conrads "with funding apparently

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<sup>35</sup> Reference 85.

provided by applicant's company, BlackLight Power Inc." Such criticism is completely off base. While true that the independent work performed at Institut fur Niedertemperatur-Plasmaphysik e.V. was supported by Applicant, it is ludicrous to suggest that the Director and Chairman of the Board of one Germany's most prestigious National Laboratories, once headed by two Noble Laureates Stark and Mie, would in any way compromise his scientific integrity.

Such unfounded criticisms stand in stark contrast to Applicant's overwhelming experimental test results that are the basis for over 50 submitted scientific papers, 34 of which have been peer-reviewed and either published or accepted for publication in highly-respected scientific journals.<sup>36</sup> It is standard practice for those holding to rigorous scientific due process to submit their results for peer review. Publication confers that the methods are scientifically sound in the view of the referees.

In Applicant's last interview with the PTO, Committee Member Jagannathan required that Applicant's technology be published in peer-reviewed journals before he would allow a patent to issue. While patentability standards do not recognize any such requirement, Applicant has clearly met this newly-imposed burden in light of the over 50 papers that have been published or accepted for publication.

The comprehensive scientific results overwhelmingly demonstrate the operability and enablement of Applicant's disclosed invention. The Committee now has the obligation to fairly analyze Applicant's experimental data, which dictates allowance of the pending claims.

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<sup>36</sup> The experimental test results are the basis of over 100 journal articles (of which over 50 have been peer-reviewed and either published or accepted for publication), 3 correspondences, and book listed.

**Applicant's response to the Committee's contention that "25. The Mills Declaration with respect to 'extramolecular ultraviolet spectroscopic data' lacks probative value"**

Applicant has demonstrated that his disclosed catalyst mechanism is not only plausible, but is, in fact, operable. Based on comments by the Committee, it clearly fails to understand how that mechanism works.

For instance, contrary to the Committee's mistaken belief, Applicant is not trying "to force a match between the input and output of energy." A resonance exists between  $He^+$  and atomic hydrogen. That is why helium ion is selected as a catalyst. The same applies for the case of strontium. Only certain ions and atoms provide a reaction that has a net enthalpy of an integer multiple of the potential energy of atomic hydrogen.

For example, the first, second, and third ionization energies of potassium are  $4.34066\text{ eV}$ ,  $31.63\text{ eV}$ , and  $45.806\text{ eV}$ , respectively. The triple ionization ( $t=3$ ) reaction of  $K$  to  $K^{3+}$ , then, has a net enthalpy of reaction of  $81.7766\text{ eV}$ , which is equivalent to  $3 \cdot 27.2\text{ eV}$ . Potassium is readily available from chemical supply companies such as Alpha Aesar. This is heated to form gaseous potassium atoms in the cell. The potassium atoms react with atomic hydrogen produced by dissociation at a hot filament for example. A hydrogen atom transfers  $81.6\text{ eV}$  to a potassium atom which is ionized to  $K^{3+}$  due to the RESONANT NONRADIATIVE ENERGY TRANSFER. The  $K^{3+}$  ion is unequivocally observed spectroscopically.<sup>37</sup>

The Committee has offered no art or explanation for the formation of  $K^{3+}$  at  $700^\circ\text{C}$ . Lower-energy hydrogen is formed as indicated by the formation of a plasma due to the energy release, and a novel hydride ion is formed with a binding energy of  $11\text{ eV}$  corresponding to the observed emission at  $110\text{ nm}$ .<sup>38</sup> Novel hydride compounds are formed.<sup>39</sup> A large enthalpy of formation of the

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<sup>37</sup> Reference 22.

<sup>38</sup> References 7 and 22.

<sup>39</sup> References 20, 40, and 42.

hydrides is observed.<sup>40</sup> No energy match is forced, as misunderstood by the Committee.

To better educate the Committee about Applicant's catalytic reaction, the following excerpt from R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Rydberg States of Atomic Hydrogen", Chem. Phys. Letts., submitted, is provided:

## 1. Introduction

J. R. Rydberg showed that all of the spectral lines of atomic hydrogen were given by a completely empirical relationship:

$$\bar{\nu} = R \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (1)$$

where  $R = 109,677 \text{ cm}^{-1}$ ,  $n_f = 1, 2, 3, \dots$ ,  $n_i = 2, 3, 4, \dots$  and  $n_i > n_f$ . Bohr, Schrodinger, and Heisenberg each developed a theory for atomic hydrogen that gave the energy levels in agreement with Rydberg's equation.

$$E_n = -\frac{e^2}{n^2 8 \pi \epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

The excited energy states of atomic hydrogen are given by Eq. (2a) for  $n > 1$  in Eq. (2b). The  $n = 1$  state is the "ground" state for "pure" photon transitions (*i.e.*, the  $n = 1$  state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [1]. Also,

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<sup>40</sup> Reference 24.

some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [2].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as  $He^+$  which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen,  $m \cdot 27.2 \text{ eV}$  wherein  $m$  is an integer. The theory was given previously [3-5]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (2c)$$

replaces the well-known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states. The  $n = 1$  state of hydrogen and the  $n = \frac{1}{\text{integer}}$  states of hydrogen are nonradiative, but a

transition between two nonradiative states is possible via a nonradiative energy transfer, say  $n = 1$  to  $n = 1/2$ . Thus, a catalyst provides a net positive enthalpy of reaction of  $m \cdot 27.2 \text{ eV}$  (i.e., it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

#### A. EUV Spectroscopy

In the case of the EUV spectrum of hydrogen, xenon, or xenon-hydrogen (98/2%), no peaks were observed below  $78 \text{ nm}$ , and no spurious peaks or artifacts due to the grating or the spectrometer were observed. Only known He I and He II peaks were observed in the EUV spectrum of the control helium microwave discharge cell emission.

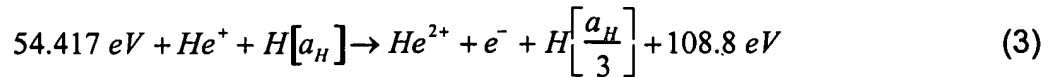
The EUV spectra ( $17.5 - 50 \text{ nm}$ ) of the microwave cell emission of the helium-hydrogen mixture (98/2%) (top curve) and the helium control (bottom curve) are shown in Figure 1. Ordinary hydrogen has no emission in these regions. Novel peaks were observed at  $45.6 \text{ nm}$ ,  $37.4 \text{ nm}$ , and  $20.5 \text{ nm}$  which do not correspond to helium. At the 1 Torr condition, additional novel



peaks were observed in the short wavelength region (5 – 65 nm) at 14.15 nm, 13.03 nm, 10.13 nm, and 8.29 nm which do not correspond to helium as shown in Figure 1. Known He I lines which were used for calibration of the novel peak positions were observed at 58.4 nm, 53.7 nm, and 52.4 nm. It is proposed that the 30.4 nm peak shown in Figures 1 and 2 was not entirely due to the He II transition. In the case of the helium-hydrogen mixture, the ratio of 30.4 nm (40.8 eV) peak to the 25.6 nm (48.3 eV) was 10 compared to 5.4 for helium alone as shown in Figure 1 which implies only a minor He II transition contribution to the 30.4 nm peak.

It is proposed that the majority of the 91.2 nm peak was also due to a novel transition. At 20 Torr, the ratio of the Lyman  $\beta$  peak to the 91.2 nm peak of the helium-hydrogen plasma was 2 compared to 8 for each control hydrogen and xenon-hydrogen plasma which indicates that the majority of the 91.2 nm peak was due to a transition other than the binding of an electron by a proton.

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at 91.2 nm, 45.6 nm, 30.4 nm, 13.03 nm, 10.13 nm, and 8.29 nm correspond to energies of  $q \cdot 13.6$  eV where  $q = 1, 2, 3, 7, 9, 11$ . In order of energy, the set comprising the peaks at 37.4 nm, 20.5 nm, and 14.15 nm correspond to energies of  $q \cdot 13.6 - 21.21$  eV where  $q = 4, 6, 8$ . These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization energy of helium is 54.417 eV, which is equivalent to  $2 \cdot 27.2$  eV. In this case, 54.417 eV is transferred nonradiatively from atomic hydrogen to  $He^+$  which is resonantly ionized. The electron decays to the  $n = 1/3$  state with the further release of 54.417 eV which may be emitted as a photon. The catalysis reaction is

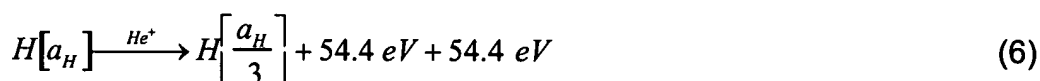


And, the overall reaction is



Since the products of the catalysis reaction have binding energies of  $m \cdot 27.2 \text{ eV}$ , they may further serve as catalysts. Thus, further catalytic transitions may occur:  $n = \frac{1}{3} \rightarrow \frac{1}{4}$ ,  $\frac{1}{4} \rightarrow \frac{1}{5}$ , and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of  $m \cdot 27.2 \text{ eV}$  would give rise to a series of emission lines of energies  $q \cdot 13.6 \text{ eV}$  where  $q$  is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction



yields  $54.4 \text{ eV}$  by Eq. (4) and a photon of  $54.4 \text{ eV}$  ( $22.8 \text{ nm}$ ). Once emitted, the photon may be absorbed or scattered. When this photon strikes  $He(1s^2)$ ,  $21.2 \text{ eV}$  may be absorbed in the excitation to  $He(1s^1 2p^1)$ . This leaves a  $33.19 \text{ eV}$  ( $37.4 \text{ nm}$ ) photon peak and a  $21.2 \text{ eV}$  ( $58.4 \text{ nm}$ ) photon from  $He(1s^1 2p^1)$ . Thus, for helium the inelastic scattered peak of  $54.4 \text{ eV}$  photons from Eq. (3) is given by

$$E = 54.4 \text{ eV} - 21.21 \text{ eV} = 33.19 \text{ eV} \text{ (} 37.4 \text{ nm)} \quad (7)$$

A novel peak shown in Figures 1 and 2 was observed at  $37.4 \text{ nm}$ . Furthermore, the intensity of the  $58.4 \text{ nm}$  peak corresponding to the spectra shown in Figure 2 was about 60,000 photons/sec. Thus, the transition  $He(1s^2) \rightarrow He(1s^1 2p^1)$  dominated the inelastic scattering of EUV peaks. The general reaction is



The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are  $13.6 \text{ eV}$ ,  $27.2 \text{ eV}$ ,  $40.8 \text{ eV}$ ,  $54.4 \text{ eV}$ ,  $81.6 \text{ eV}$ ,  $95.2 \text{ eV}$ ,  $108.8 \text{ eV}$ ,  $122.4 \text{ eV}$  and  $149.6 \text{ eV}$ . The corresponding peaks are  $91.2 \text{ nm}$ ,  $45.6 \text{ nm}$ ,  $30.4 \text{ nm}$ ,  $37.4 \text{ nm}$ ,  $20.5 \text{ nm}$ ,  $13.03 \text{ nm}$ ,  $14.15 \text{ nm}$ ,  $10.13 \text{ nm}$ , and  $8.29 \text{ nm}$ , respectively. Thus, the identified novel lines correspond to energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$  or these lines inelastically scattered by helium atoms wherein  $21.2 \text{ eV}$  was absorbed in the excitation of  $He(1s^2)$  to  $He(1s^1 2p^1)$ . The values of  $q$  observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed

previously [6]. The satellite peak at 44.2 *nm* show in Figure 1 and 2 may be due to multipole coupling as discussed elsewhere [12].

There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the  $q \cdot 13.6 \text{ eV}$  related set of peaks.

The Committee's refusal to consider Applicant's data of lower-energy hydrogen transitions is based on the false premise that it violates quantum theory. Applicant's theory, however, does not violate physical laws, such as Maxwell's equation, with which the Committee's cited theory conflicts.<sup>41</sup>

THEORY MUST CONFORM TO DATA, RATHER THAN DATA CONFORM TO THEORY AS ESPOUSED BY THE COMMITTEE. THE COMMITTEE HAS SHOWN A CLEAR BIAS IN ITS DEFENSE OF QUANTUM MECHANICS, BUT IT CANNOT MAKE APPLICANT'S DATA GO AWAY JUST BECAUSE IT WISHES IT SO. APPLICANT HAS MET THE BURDEN OF SHOWING THE SPECTRAL LINES DEMANDED BY THE SECRET COMMITTEE. THE COMMITTEE HAS OFFERED NO OTHER EXPLANATION OF THESE LINES. APPLICANT HAS A RIGHT TO HAVE HIS APPLICATION FAIRLY EVALUATED—NOT DISMISSED OUT OF HAND.

The stability of the hydrino states is disclosed in the Appendix attached to this Response. The excited state lines of hydrogen are shown in Applicant's publications.<sup>42</sup> The hydrino transitions are also observed when a catalyst (in this case) is provided.<sup>43</sup> In the case of the spectrum of Bethe and Salpeter, no catalyst was present. Thus, no hydrino lines are predicted by Applicant and none were observed in agreement with Applicant's theory. As pointed out in other sections of the Appendix attached to this Response, such as, standard quantum

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<sup>41</sup> The fallacies of the Secret Committee's theoretical argument are pointed out in the Appendix attached to this Response.

<sup>42</sup> Reference 21.

<sup>43</sup> Reference 21.

mechanics cannot possibly be the absolute representation of the hydrogen atom from which absolute conclusions about the existence or nonexistence of hydrinos can be drawn.

The Committee has it exactly backwards. Applicant's spectral lines disprove quantum mechanics. Applicant's theory is based on Maxwell's equations, which is a physical law. [See Appendix to this Response] The Committee relies on a fatally flawed, internally inconsistent, probability wave theory as the sole basis to reject the present invention.

The Committee is further misguided and incorrect in its assessment that "Hence, standard quantum mechanics is a thousand times more accurate in its predictive power, for the spectral lines of the hydrogen atom, compared to applicant's improper theory." Only Applicant's theory is derived from first principles and holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos. Quantum mechanics and the Heisenberg Uncertainty Principle are not laws of nature. They are based on circular arguments that the electron is a probability wave requiring that the electron have multiple positions and energies including negative and infinite energies simultaneously. Both are postulated, cannot be proven experimentally, and predict consequences such as violation of conservation of energy and momentum and an essentially infinite cosmological constant. These predictions are not in agreement with experimentation.

Furthermore, it was recently proven experimentally that the Heisenberg Uncertainty Principle has nothing to do with wave-particle duality;<sup>44</sup> whereas, the opposite is largely touted as one of its triumphs. In contrast, the observable features of atomic particles such as the electron g factor may be calculated in closed form from Maxwell's equations with 11-figure accuracy without invoking the vagaries and inconsistencies inherent with the Heisenberg Uncertainty Principle.<sup>45</sup> And, Applicant predicts fractional quantum states as "allowed" in the

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<sup>44</sup> References 32 and 45.

<sup>45</sup> Reference 39.

Rydberg energy equation, which states are demonstrated experimentally. The Secret Committee has offered no explanation for the data summarized in this Response. The Committee cannot simply dismiss that data out of hand so as to avoid dealing with the conclusions to be drawn from it.

Both of the papers discussed in the Mills Declaration and mentioned by the Committee have gone through extensive peer review and thus are even more compelling. They are scheduled to appears as new journal articles:

R. Mills, P. Ray, "Spectroscopic Identification of a Novel Catalytic Reaction of Potassium and Atomic Hydrogen and the Hydride Ion Product", Int. J. Hydrogen Energy, Vol. 27, No. 2, February, (2002), pp. 183-192.

R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, Vol. 27, No. 3, (2002), pp. 301-322.

In addition, Applicant has obtained overwhelming spectroscopic data of the existence of lower-energy hydrogen, which matches theoretical predictions remarkably well. For example, on page 4, lines 8-12 of the present specification, Applicant discloses:

The hydride ion of the present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{n^2} \quad (2)$$

where  $n = \frac{1}{p}$  and  $p$  is an integer greater than one.

From R. L. Mills, P. Ray, B. Dhandapani, J. He, "Spectroscopic Identification of Fractional Rydberg States of Atomic Hydrogen", J. of Phys. Chem. (letter), submitted:

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel

emission lines were observed with energies of  $q \cdot 13.6 \text{ eV}$  where  $q = 1, 2, 3, 4, 6, 7, 8, 9, 11, 12$  or these lines inelastically scattered by helium atoms wherein  $21.2 \text{ eV}$  was absorbed in the excitation of  $\text{He}(1s^2)$  to  $\text{He}(1s^1 2p^1)$ . These lines can be explained as fractional Rydberg states of atomic hydrogen. Novel emission lines were also observed at  $44.2 \text{ nm}$  and  $40.5 \text{ nm}$  with energies of

$$q \cdot 13.6 + \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \times 13.6 \text{ eV} \text{ where } q = 2 \text{ and } n_f = 2, 4 \text{ } n_i = \infty \text{ that}$$

corresponded to multipole coupling to give two photon emission from a continuum excited state atom and an atom undergoing a fractional Rydberg state transition. Such transitions would be extremely energetic; so, the width of the  $656.2 \text{ nm}$  Balmer  $\alpha$  line emitted from the plasmas was measured, and the electron temperature  $T_e$  was measured from the ratio of the intensity of the  $\text{He } 501.6 \text{ nm}$  line to that of the  $\text{He } 492.2$  line. Significant line broadening corresponding to an average hydrogen atom temperature of  $180 - 210 \text{ eV}$  was observed for helium-hydrogen microwave plasmas; whereas, pure hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of  $\approx 3 \text{ eV}$ . Similarly, the average electron temperature for helium-hydrogen plasma was  $28,000 \text{ K}$ ; whereas, the corresponding temperature of helium alone was only  $6800 \text{ K}$ .

THE COMMITTEE OFFERS NO EXPLANATION FOR THIS DATA OF LOWER-ENERGY ATOMIC HYDROGEN EMISSION—BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 3, line 30 through page 4, line 19 of the present specification, Applicant discloses:

#### SUMMARY OF THE INVENTION

This invention is directed to a new composition of matter comprising a hydride ion ( $H^-$ ) having a binding energy greater than  $0.8 \text{ eV}$ , as reflected in the following formula

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left\{ 1 + \frac{2^2}{\left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right\} \quad (1)$$

where  $p$  is an integer greater than one,  $s = 1/2$ ,  $\pi$  is pi,  $\hbar$  is Planck's constant bar,  $\mu_0$  is the permeability of vacuum,  $m_e$  is the mass of the electron,  $\mu_e$  is the reduced electron mass,  $a_0$  is the Bohr radius, and  $e$  is the elementary charge. An ion comprising an ordinary hydrogen nucleus and two electrons having the binding energy of 0.8 eV is hereinafter referred to as "ordinary hydride ion." The hydride ion comprises two indistinguishable electrons bound to a proton. The hydride ion of the present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{n^2} \quad (2)$$

where  $n = \frac{1}{p}$  and  $p$  is an integer greater than one. (The binding energy is the energy required to remove an electron from an atom or a molecule and is equivalent to the ionization energy.) A hydrogen atom having the binding energy given in Eq. (2) is hereafter referred to as a hydrino atom or hydrino. The designation for a hydrino of radius  $\frac{a_H}{p}$ , where  $a_H$  is the radius of an ordinary hydrogen atom and  $p$  is an integer, is  $H\left[\frac{a_H}{p}\right]$ . A hydrogen atom with a radius  $a_H$  is hereinafter referred to as "ordinary hydrogen atom."

Hydrinos are formed by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

$$m \cdot 27.21 \text{ eV} \quad (3)$$

where  $m$  is an integer.

This catalysis releases energy with a commensurate decrease in size of the hydrogen atom,  $r_n = na_H$ . For example, the catalysis of  $H(n=1)$  to  $H(n=1/2)$  releases 40.8 eV, and the

hydrogen radius decreases from  $a_H$  to  $\frac{1}{2} a_H$ . One such catalytic system involves potassium. The second ionization energy of potassium is  $31.63 \text{ eV}$ ; and  $K^+$  releases  $4.34 \text{ eV}$  when it is reduced to  $K$ . The combination of reactions  $K^+$  to  $K^{2+}$  and  $K^+$  to  $K$ , then, has a net enthalpy of reaction of  $27.28 \text{ eV}$ , which is equivalent to  $m = 1$  in Eq. (3).

$$27.28 \text{ eV} + K^+ + K^+ + H\left[\frac{a_H}{p}\right] \rightarrow K + K^{2+} + H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (4)$$



The overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (6)$$

Note that the energy given off during catalysis is much greater than the energy lost to the catalyst. The energy released is large as compared to conventional chemical reactions. For example, when hydrogen and oxygen gases undergo combustion to form water



the known enthalpy of formation of water is  $\Delta H_f = -286 \text{ kJ / mole}$  or  $1.48 \text{ eV}$  per hydrogen atom. By contrast, each ( $n = 1$ ) ordinary hydrogen atom undergoing catalysis releases a net of  $40.8 \text{ eV}$ . Moreover, further catalytic transitions may occur:

$n = \frac{1}{2} \rightarrow \frac{1}{3}, \frac{1}{3} \rightarrow \frac{1}{4}, \frac{1}{4} \rightarrow \frac{1}{5}$ , and so on. Once catalysis begins,

hydrinos autocatalyze further in a process called disproportionation. This mechanism is similar to that of an inorganic ion catalysis. But, hydrino catalysis should have a higher reaction rate than that of the inorganic ion catalyst due to the better match of the enthalpy to  $m \cdot 27.2 \text{ eV}$ .

From R. L. Mills, P. Ray, "High Resolution Spectroscopic Observation of the Bound-Free Hyperfine Levels of a Novel Hydride Ion Corresponding to a Fractional Rydberg State of Atomic Hydrogen", Int. J. Hydrogen Energy, in press:



From a solution of a Schrodinger-type wave equation with a nonradiative boundary condition based on Maxwell's equations, Mills solves the hydrogen atom, the hydride ion, and predicts corresponding species having fractional principal quantum numbers. Atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen,  $m \cdot 27.2 \text{ eV}$  wherein  $m$  is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom  $H(1/p)$  that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number

$(n = \frac{1}{p} = \frac{1}{\text{integer}})$  replaces the well known parameter  $n = \text{integer}$  in

the Rydberg equation for hydrogen excited states). The ionization of  $Rb^+$  and an electron transfer between two  $K^+$  ions ( $K^+ / K^+$ ) provide a reaction with a net enthalpy of  $27.2 \text{ eV}$  which serve as catalysts of atomic hydrogen to form  $H(1/2)$ . Intense extreme ultraviolet (EUV) emission was observed from incandescently heated atomic hydrogen and each of atomized potassium and rubidium ions that generated a plasma called a resonance transfer or rt-plasma at low temperatures (e.g.  $\approx 10^3 \text{ K}$ ) and an extraordinary low field strength of about 1-2 V/cm. For further characterization, the width of the  $6562 \text{ \AA}$  Balmer  $\alpha$  line was recorded. Significant line broadening of 17 and 9 eV was observed from a rt-plasma of hydrogen with  $K^+ / K^+$  and  $Rb^+$  respectively. These results could not be explained by Stark or thermal broadening or electric field acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV. Rather the source of the excessive line broadening is consistent with that of the observed EUV emission, an energetic reaction caused by a resonance energy transfer between hydrogen atoms and  $K^+ / K^+$  or  $Rb^+$ . The catalyst product  $H(1/2)$  was predicted to be a highly reactive intermediate which further reacts to form a novel hydride ion  $H^-(1/2)$ . This hydride ion with a predicted binding energy of  $3.0468 \text{ eV}$  was observed by high-resolution visible spectroscopy as a broad peak at  $4070.0 \text{ \AA}$  with a FWHM of  $1.4 \text{ \AA}$ . From the electron  $g$  factor, bound-free hyperfine structure lines of  $H^-(1/2)$  were predicted with energies  $E_{HF}$  given by  $E_{HF} = j^2 3.0056 \times 10^{-5} + 3.0575 \text{ eV}$  ( $j$  is an integer) as an inverse Rydberg-type series that converges at increasing wavelengths and terminates at  $3.0575 \text{ eV}$ —the hydride spin-pairing energy plus the binding energy. The high-resolution visible plasma emission

spectra in the region of 4000 Å to 4060 Å matched the predicted emission lines for  $j = 1$  to  $j = 37$  to 1 part in  $10^5$ .

THE SECRET COMMITTEE OFFERS NO EXPLANATION FOR THIS DATA OF LOWER-ENERGY HYDRIDE ION EMISSION AND EXTRAORDINARY PLASMA FORMATION GIVEN THE CONDITIONS, BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 41, line 24 through page 43, line 23 of the present specification, Applicant discloses:

#### DIHYDRINO METHODS

The theoretical introduction to dihydrinos is provided in the '96 Mills GUT. Two hydrino atoms  $H\left[\frac{a_H}{p}\right]$  may react to form a diatomic molecule referred to as a dihydrino  $H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]$ .

$$2H\left[\frac{a_H}{p}\right] \rightarrow H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right] \quad (23)$$

where  $p$  is an integer. The dihydrino comprises a hydrogen molecule having a total energy,  $E_T\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right)$ ,

$$E_T\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right) = -13.6 \text{ eV} \left[ \left( 2p^2\sqrt{2} - p^2\sqrt{2} + \frac{p^2\sqrt{2}}{2} \right) \ln \frac{\sqrt{2}+1}{\sqrt{2}-1} - p^2\sqrt{2} \right] \quad (24)$$

where  $2c'$  is the internuclear distance and  $a_0$  is the Bohr radius. Thus, the relative internuclear distances (sizes) of dihydrinos are fractional. Without considering the correction due to zero order vibration, the bond dissociation energy,  $E_D\left(H_2^*\left[2c' = \frac{\sqrt{2}a_0}{p}\right]\right)$ , is given by the difference between the energy of two hydrino atoms

each given by the negative of Eq. (2) and the total energy of the dihydrino molecule given by Eq. (24). (The bond dissociation energy is defined as the energy required to break the bond).

$$E_T \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right) = 13.6 \text{ eV} (-4p^2 \ln 3 + p^2 + 2p^2 \ln 3) \quad (26)$$

The first binding energy,  $BE_1$ , of the dihydrino molecular ion with consideration of zero order vibration is about

$$BE_1 = \frac{16.4}{\left( \frac{1}{p} \right)^2} \text{ eV} \quad (26a)$$

Without considering the correction due to zero order vibration, the bond dissociation energy,  $E_D \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right)$ , is the difference between the negative of the binding energy of the corresponding hydrino atom given by Eq. (2) and  $E_T \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right)$  given by Eq. (26).

$$E_D \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right) = E \left( H \left[ \frac{a_H}{p} \right] \right) - E_T \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right) \quad (27)$$

The first binding energy,  $BE_1$ , of the dihydrino molecule

$$H_2^* \left[ 2c' = \frac{\sqrt{2}a_e}{p} \right] \rightarrow H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ + e^- \quad (28)$$

is given by Eq. (26) minus Eq. (24).

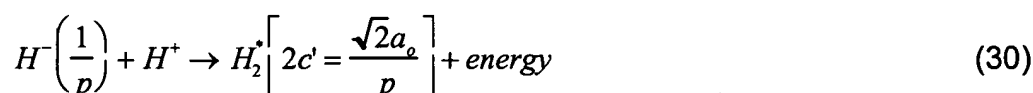
$$BE_1 = E_T \left( H_2^* \left[ 2c' = \frac{2a_e}{p} \right]^+ \right) - E_T \left( H_2^* \left[ 2c' = \frac{\sqrt{2}a_e}{p} \right] \right) \quad (29)$$

The second binding energy,  $BE_2$ , is given by the negative of Eq. (26). The first binding energy,  $BE_1$ , of the dihydrino molecule with consideration of zero order vibration is about

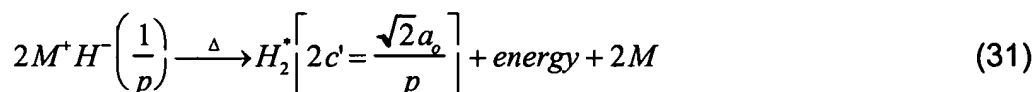
$$BE_1 = \frac{15.5}{\left(\frac{1}{p}\right)^2} \text{ eV} \quad (29a)$$

The dihydrino and the dihydrino ion are further described in the '96 Mills GUT, and PCT/US96/07949 and PCT/US/94/02219.

A method to prepare dihydrino gas from the hydrino hydride comprises reacting hydrino hydride with a source of protons including acid, protons of a plasma of a gas discharge cell, and protons from a metal hydride. The reaction of hydrino hydride  $H^-\left(\frac{1}{p}\right)$  with a proton is

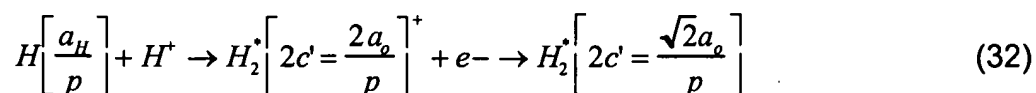


One way to make dihydrino gas from hydrino hydride is by thermally decomposing the hydride. For example, potassium hydrino hydride is heated until potassium metal is formed together with dihydrino gas. An example of a thermal decomposition reaction of hydrino hydride  $M^+H^-\left(\frac{1}{p}\right)$  is



where  $M^+$  is the cation.

A hydrino can react with a proton to form a dihydrino ion which further reacts with an electron to form a dihydrino molecule.



The energy of the reaction of the hydrino atom with a proton is given by the negative of the bond energy of the dihydrino ion (Eq. (27)). The energy given by the reduction of the dihydrino ion by an electron is the negative of the first binding energy (Eq. (29)). These reactions emit UV radiation. UV spectroscopy is a way to study the emitted radiation.

From R. Mills, P. Ray, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Hydrogen Molecular Ion", *Int. J. Hydrogen Energy*, in press:

From a solution of a Schrodinger-type wave equation with a nonradiative boundary condition based on Maxwell's equations, Mills solves the hydrogen atom, the hydrogen molecular ion, the hydrogen molecule and predicts corresponding species having fractional principal quantum numbers. Atomic hydrogen may undergo a catalytic reaction with certain atomized elements and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen,  $m \cdot 27.2 \text{ eV}$  wherein  $m$  is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom  $H(1/p)$  that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number ( $n = \frac{1}{p} = \frac{1}{\text{integer}}$  replaces the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen excited states). One such atomic catalytic system involves argon ions. The reaction  $Ar^+$  to  $Ar^{2+}$  has a net enthalpy of reaction of  $27.63 \text{ eV}$ , which is equivalent to  $m = 1$ . Thus, it may serve as a catalyst to form  $H(1/2)$ . Also, the second ionization energy of helium is  $54.4 \text{ eV}$ ; thus, the ionization reaction of  $He^+$  to  $He^{2+}$  has a net enthalpy of reaction of  $54.4 \text{ eV}$  which is equivalent to  $2 \cdot 27.2 \text{ eV}$ . The products of the catalysis reaction  $H(1/3)$  may further serve as catalysts to form  $H(1/4)$  and  $H(1/2)$ .  $H(1/p)$  may react with a proton to form an excited state molecular ion  $H_2^+(1/p)^+$  that has a bond energy and vibrational levels that are  $p^2$  times those of the molecular ion comprising uncatalyzed atomic hydrogen where  $p$  is an integer. Thus, the excited state spectrum of  $H_2^+[n = 1/4; n^* = 2]^+$  was predicted to comprise rotationally broadened vibrational transitions at  $1.185 \text{ eV}$  increments to the dissociation limit of  $H_2^+[n = 1/4]^+$ ,  $E_D = 42.88 \text{ eV}$  ( $28.92 \text{ nm}$ ). Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of argon or helium with 10% hydrogen in the range  $10 - 65 \text{ nm}$ . Novel emission lines assigned to vibrational transitions of  $H_2^+[n = 1/4; n^* = 2]^+$  were observed in this range with energies of  $\nu \cdot 1.185 \text{ eV}$ ,  $\nu = 17 \text{ to } 38$  that terminated at about  $28.9 \text{ nm}$ . In addition, fractional molecular hydrogen rotational transitions were assigned to previously unidentified lines in the solar coronal spectrum that matched theoretical predictions to five figures.

THE COMMITTEE OFFERS NO EXPLANATION WHICH COULD CHALLENGE THIS NEWLY SUBMITTED DATA OF LOWER-ENERGY HYDROGEN MOLECULAR ION EMISSION, BUT RATHER, MERELY DISMISSES IT BASED ON A FLAWED THEORY.

From page 3, line 30 through page 11, line 13 of the present specification, Applicant discloses:

### SUMMARY OF THE INVENTION

This invention is directed to a new composition of matter comprising a hydride ion ( $H^-$ ) having a binding energy greater than 0.8 eV, as reflected in the following formula

$$Binding\ Energy = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi\mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left( 1 + \frac{2^2}{\left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right) \quad (1)$$

where  $p$  is an integer greater than one,  $s = 1/2$ ,  $\pi$  is pi,  $\hbar$  is Planck's constant bar,  $\mu_0$  is the permeability of vacuum,  $m_e$  is the mass of the electron,  $\mu_e$  is the reduced electron mass,  $a_0$  is the Bohr radius, and  $e$  is the elementary charge. An ion comprising an ordinary hydrogen nucleus and two electrons having the binding energy of 0.8 eV is hereinafter referred to as "ordinary hydride ion." The hydride ion comprises two indistinguishable electrons bound to a proton. The hydride ion of the present invention is formed by the reaction of an electron with a hydrogen atom having a binding energy given by

$$Binding\ Energy = \frac{13.6\ eV}{n^2} \quad (2)$$

where  $n = \frac{1}{p}$  and  $p$  is an integer greater than one. (The binding energy is the energy required to remove an electron from an atom or a molecule and is equivalent to the ionization energy.) A hydrogen atom having the binding energy given in Eq. (2) is hereafter referred to as a hydrino atom or hydrino. The designation

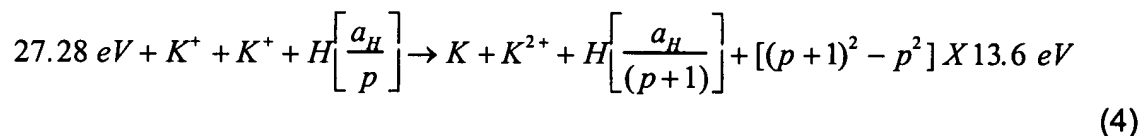
for a hydrino of radius  $\frac{a_H}{p}$ , where  $a_H$  is the radius of an ordinary hydrogen atom and  $p$  is an integer, is  $H\left[\frac{a_H}{p}\right]$ . A hydrogen atom with a radius  $a_H$  is hereinafter referred to as "ordinary hydrogen atom."

Hydrinos are formed by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

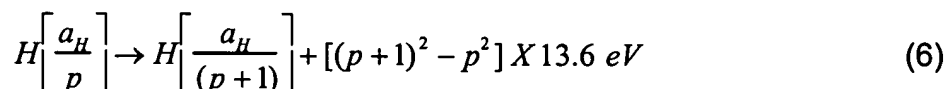
$$m \cdot 27.21 \text{ eV} \quad (3)$$

where  $m$  is an integer.

This catalysis releases energy with a commensurate decrease in size of the hydrogen atom,  $r_n = na_H$ . For example, the catalysis of  $H(n=1)$  to  $H(n=1/2)$  releases  $40.8 \text{ eV}$ , and the hydrogen radius decreases from  $a_H$  to  $\frac{1}{2}a_H$ . One such catalytic system involves potassium. The second ionization energy of potassium is  $31.63 \text{ eV}$ ; and  $K^+$  releases  $4.34 \text{ eV}$  when it is reduced to  $K$ . The combination of reactions  $K^+$  to  $K^{2+}$  and  $K^+$  to  $K$ , then, has a net enthalpy of reaction of  $27.28 \text{ eV}$ , which is equivalent to  $m=1$  in Eq. (3).



The overall reaction is



Note that the energy given off during catalysis is much greater than the energy lost to the catalyst. The energy released is large as compared to conventional chemical reactions. For example, when hydrogen and oxygen gases undergo combustion to form water



the known enthalpy of formation of water is  $\Delta H_f = -286 \text{ kJ / mole}$  or 1.48 eV per hydrogen atom. By contrast, each ( $n = 1$ ) ordinary hydrogen atom undergoing catalysis releases a net of 40.8 eV. Moreover, further catalytic transitions may occur:

$n = \frac{1}{2} \rightarrow \frac{1}{3}, \frac{1}{3} \rightarrow \frac{1}{4}, \frac{1}{4} \rightarrow \frac{1}{5}$ , and so on. Once catalysis begins,

hydrinos autocatalyze further in a process called disproportionation. This mechanism is similar to that of an inorganic ion catalysis. But, hydrino catalysis should have a higher reaction rate than that of the inorganic ion catalyst due to the better match of the enthalpy to  $m \cdot 27.2 \text{ eV}$ .

Hydrino  $H \left[ \frac{a_H}{p} \right]$  reacts with an electron to form a corresponding hydrino hydride ion, hereinafter designated as  $H^-(n = 1 / p)$ :



The binding energies of the hydrino hydride ion  $H^-(n = 1 / p)$  as a function of  $p$ , where  $p$  is an integer, are shown in TABLE 1.



TABLE 1. The representative binding energy of the hydrino hydride ion  $H^-(n = 1/p)$  as a function of  $p$ , Eq. (1).

Hydride Ion	$r_1$ ( $a_0$ ) <sup>a</sup>	Binding Energy <sup>b</sup> (eV)	Wavelength (nm)
$H^-(n = 1/2)$	0.9330	3.047	407
$H^-(n = 1/3)$	0.6220	6.610	188
$H^-(n = 1/4)$	0.4665	11.23	110
$H^-(n = 1/5)$	0.3732	16.70	74.2
$H^-(n = 1/6)$	0.3110	22.81	54.4
$H^-(n = 1/7)$	0.2666	29.34	42.3
$H^-(n = 1/8)$	0.2333	36.08	34.4
$H^-(n = 1/9)$	0.2073	42.83	28.9
$H^-(n = 1/10)$	0.1866	49.37	25.1
$H^-(n = 1/11)$	0.1696	55.49	22.3
$H^-(n = 1/12)$	0.1555	60.97	20.3
$H^-(n = 1/13)$	0.1435	65.62	18.9
$H^-(n = 1/14)$	0.1333	69.21	17.9
$H^-(n = 1/15)$	0.1244	71.53	17.3
$H^-(n = 1/16)$	0.1166	72.38	17.1

<sup>a</sup> Equation (21)

<sup>b</sup> Equation (22)

According to the present invention, a hydride ion ( $H^-$ ) is provided having a binding energy greater than 0.8 eV. The binding energy, also known as the ionization energy, of an atom, ion or molecule is the energy required to remove one electron from the atom, ion or molecule. Hydride ions having a binding of about 3, 7, 11, 17, 23, 29, 36, 43, 49, 55, 61, 66, 69, 71 and 72 eV are provided.

From R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", *Int. J. of Hydrogen Energy*, Vol. 26, No. 4, (2001), pp. 339-367:

Novel inorganic alkali and alkaline earth hydrides of the formula  $MHX$  and  $MHMX$  wherein  $M$  is the metal,  $X$ , is a singly negatively charged anion, and  $H$  comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell

by reaction of atomic hydrogen with a catalyst and  $MX$  or  $MX_2$  corresponding to an alkali metal or alkaline earth metal, respectively. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g.  $\approx 10^3$  K) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1-6]. These atomized elements or certain gaseous ions comprised the catalyst to form  $MHX$  and  $MHMX$ . For example, atomic hydrogen was reacted with strontium vapor and  $SrBr_2$  to form  $SrHBr$ . Novel hydride compounds such as  $SrHBr$  were identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy, proton nuclear magnetic resonance spectroscopy, and thermal decomposition with analysis by gas chromatography, and mass spectroscopy. Hydride ions with increased binding energies form novel compounds with potential broad applications such as a high voltage battery for consumer electronics and electric vehicles. In addition, these novel compositions of matter and associated technologies may have far-reaching applications in many industries including chemical, electronics, computer, military, energy, and aerospace in the form of products such as propellants, solid fuels, surface coatings, structural materials, and chemical processes.

The Committee offers no explanation for this data of novel lower-energy-hydrogen compounds, but rather, merely dismisses it based on a flawed theory and presents  $\beta - Mg_2NiH_4$  as the prior art for the disclosed alkali and alkaline earth hydrides and halido hydrides.

Much of the data provided is spectroscopic data.<sup>46</sup> The spectra from state-of-the-art instruments were provided for the Committee's consideration. The Committee has presented no other explanation for the observed peaks. Only hydrogen and helium were present. Hydrogen has no peaks short of 78 nm, and the except for 30.4 nm, none of the 13 peaks identified by Applicant that are correspond to helium.

The Committee has not presented any plausible argument why any other laboratory would record a different spectrum than those provided by Applicant. For example, whether our commercial instrument records the spectrum of a

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<sup>46</sup> Reference 21.

helium plasma at Princeton, BlackLight's facility, or any other laboratory in the world, the instrument would be expected to perform identically. The spectral data stands on its own, and the Committee is obligated to offer another explanation for the peaks or allow the patent to issue.

Extensive new data submitted to peer reviewed journals since the Mills Declaration was submitted has been provided to the Committee.

Regarding presentations of Applicant's experimental data, each presentation, contrary to the Committee's assertions, was independent and scientifically sophisticated, requiring a significant effort on the part of each individual Ph.D. scientist to prepare and present. It is irrelevant whether multiple presentations were given at any particular scientific meeting, or whether they all occurred at separate meetings. Furthermore, poster presentations are significant. Applicant and the 11 BlackLight Ph.D.'s have made over 27 oral or poster presentations at various meetings with more in progress. Despite the Committee's attempt to belittle these presentations, tremendous effort and care goes into making them.

Among these presentations, Applicant gave two oral presentations and a poster presentation at the Fall 2001 National Meeting of the American Chemical Society:

1. R. Mills, "Novel catalytic reaction of hydrogen as a potential new energy source", Division of Industrial and Engineering Chemistry; Session: Industrial Bio-Based Technology, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.
2. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Inorganic Chemistry; Session: Catalysis, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.
2. R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen", Division of Physical Chemistry; Session: Physical Chemistry Poster Session, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.

Dr. Ray gave an oral presentation at the recent 54th Annual Gaseous Electronics Conference of the American Physical Society Meeting:

P. Ray, R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen plasma", Session ET1: Lighting, American Physical Society Meeting, 54th Annual Gaseous Electronics Conference, October 9–12, 2001, Pennsylvania State University, State College, PA.

Dr. Dayalan presented a talk at the Long Beach Annual Battery Conference 2002, January 15–18, 2002, California State University at Long Beach, CA:

R. L. Mills, E. Dayalan, "Novel Alkali and Alkaline Earth Hydrides for High Voltage and High Energy Density Batteries", Proceedings of the 17<sup>th</sup> Annual Battery Conference on Applications and Advances, California State University, Long Beach, CA, (January 15-18, 2002), in press.

Applicant spoke at the National American Chemical Society Meeting in April, 2002.

Applicant spoke about his lower-energy hydrogen technology at the following six National American Chemical Society Meetings:

1. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Spectroscopic Identification of a Novel Catalytic Reaction of Hydrogen", Division of Inorganic Chemistry, Oral Presentation, 223<sup>rd</sup> ACS National Meeting, (April 7–11, 2002), Orlando, FL.
2. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Inorganic Chemistry, Oral Presentation, 223<sup>rd</sup> ACS National Meeting, (April 7–11, 2002), Orlando, FL.
3. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division

of Industrial and Engineering Chemistry, Oral Presentation, 223<sup>rd</sup>  
ACS National Meeting, (April 7–11, 2002), Orlando, FL.

4. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Catalysis and Surface Science Secretariat, Oral Presentation, 223<sup>rd</sup> ACS National Meeting, (April 7–11, 2002), Orlando, FL.
5. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Physical Chemistry, Poster Presentation, 223<sup>rd</sup> ACS National Meeting, (April 7–11, 2002), Orlando, FL.
6. R. L. Mills, J. Dong, J. He, B. Dhandapani, W. Good, A. Voigt, S. Hicks, M. Nansteel, E. Dayalan, P. Chandra, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source", Division of Physical Chemistry, Sci-Mix Poster Presentation, 223<sup>rd</sup> ACS National Meeting, (April 7–11, 2002), Orlando, FL.

Applicant also presented his lower-energy hydrogen technology at the following conferences:

7. R. M. Mayo, R. L. Mills, M. Nansteel, "Direct Plasmadynamic Conversion of Plasma Thermal Power from a Novel Plasma Source to Electricity for Microdistributed Power Applications", 40<sup>th</sup> Power Sources Conference, (June 6–13, 2002), Cherry Hill, NJ.
8. R. L. Mills, E. Dayalan, "Novel Alkali and Alkaline Earth Hydrides for High Voltage and High Energy Density Batteries", Proceedings of the 17<sup>th</sup> Annual Battery Conference on Applications and Advances, California State University, Long Beach, CA, (January 15-18, 2002), in press.

Applicant gave the following presentation on his theory:

R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Global Foundation, Inc. Orbis Scientiae entitled *The Role of Attractive and Repulsive Gravitational Forces in Cosmic Acceleration of Particles The Origin of the Cosmic Gamma Ray Bursts*, (29th Conference on High Energy Physics and Cosmology

Since 1964) Dr. Behram N. Kursunoglu, Chairman, December 14-17, 2000, Lago Mar Resort, Fort Lauderdale, FL.

Applicant's talk was published in the proceedings of that meeting:

R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Global Foundation, Inc. Orbis Scientiae entitled *The Role of Attractive and Repulsive Gravitational Forces in Cosmic Acceleration of Particles The Origin of the Cosmic Gamma Ray Bursts*, (29th Conference on High Energy Physics and Cosmology Since 1964) Dr. Behram N. Kursunoglu, Chairman, December 14-17, 2000, Lago Mar Resort, Fort Lauderdale, FL, Kluwer Academic/Plenum Publishers, New York, pp. 243-258.

Applicant was invited to submit a paper based on this presentation at the National Hydrogen Association Meeting that was published in the proceedings of the meeting:

R. Mills, "BlackLight Power Technology-A New Clean Hydrogen Energy Source with the Potential for Direct Conversion to Electricity", Proceedings of the National Hydrogen Association, 12th Annual U.S. Hydrogen Meeting and Exposition, *Hydrogen: The Common Thread*, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001), pp. 671-697.

Applicant gave a presentation on his process, novel compounds, and power technologies, which were published in the proceedings of the meeting:

R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity", Global Foundation International Conference on "Global Warming and Energy Policy", Dr. Behram N. Kursunoglu, Chairman, Fort Lauderdale, FL, November 26-28, 2000, Kluwer Academic/Plenum Publishers, New York, pp. 1059-1096.

These are but a few examples of the many presentations Applicant has given, which demonstrate how far Applicant has gone to present his technology to the public. Like with so many issues in this case, however, the Committee has once again held Applicant to an unfair standard, thus, prejudicing his patent rights.

**Applicant's response to Committee's contention that "20. Calorimetric experiments purporting to demonstrate 'apparent excess heat' cannot be accepted *uncritically*"**

Applicant agrees with the Committee that an accurate calorimetric study of an electrolytic cell requires attention to recombination, heat gradients, careful measurements, etc. The Committee fails to realize, however, that Applicant has generated substantial calorimetric data and uses many tests in addition to calorimetry to confirm the disclosed novel chemistry as summarized in this Response.

**Applicant's response to the Committee's contention that "21. Applicant's calorimetric experimental data are not persuasive"**

Applicant is struck by the Committee's statement that the NASA group was receptive to the idea of "hydrinos." How does the Committee know this? In fact, the report was delayed for two years as strong opponents to "hydrinos" argued against the positive results.

In the NASA report,<sup>47</sup> NASA Lewis tested a cell identical to that of Thermacore,<sup>48</sup> with the exception that it was minus the central cathode. A cell identical to the test cell with heater power only (no electrolysis) was the calibration control and the blank cell with the heater power equal to zero. The test cell was also calibrated "on the fly" by measuring the temperature relative to the blank cell at several values of heater input power of the test cell. "Replication of experiments claiming to demonstrate excess heat production in light water-Ni-K<sub>2</sub>CO<sub>3</sub> electrolytic cells was found to produce an apparent excess heat of 11 W maximum, for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68." The production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power.

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<sup>47</sup> Reference 58.

<sup>48</sup> Reference 47.

The Committee should also know that Thermacore, Inc. is not Applicant's company. It is a well-respected heat transfer company, which is now a subsidiary of Modine, a multi-billion dollar heat management company. Thermacore's results were published<sup>49</sup> with data obtained at the same time at Applicant's company.

Specifically, calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed by Thermacore. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions. The pH, specific gravity, concentration of  $K_2CO_3$ , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

The product of the exothermic reaction is atoms having electrons of energy below the "ground state" which are predicted to form molecules. The predicted molecules were identified by lack of reactivity with oxygen, by separation from molecular deuterium by cryofiltration, and by mass spectroscopic analysis. The combustion of the gases evolved during the electrolysis of a light water  $K_2CO_3$  electrolyte ( $K^+/K^+$  electrocatalytic couple) with a nickel cathode was incomplete. The mass spectroscopic analysis of the  $m/e = 2$  peak of the

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<sup>49</sup> Reference 47.



combusted gas demonstrated that the dihydrido molecule,  $H_2(n = 1/2)$ , has a higher ionization energy than  $H_2$ .

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single-cell dewar calorimetry cells by HydroCatalysis Power Corporation (now BlackLight Power, Inc.). Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

Thermacore measured more heat out than total input power by a factor greater than 8; thus, the heat could not have been due to recombination. The experiment was performed very carefully with temperature gradients eliminated by insuring adequate stirring which was checked. Proper measurement procedures were used. The Thermacore cell was vented through a condenser to eliminate evaporative water losses. The Faraday efficiency was checked. From p. 115:

From the condensed evolving water vapor, the evaporative losses from Experiment # 4 were measured to be 6.5 ml per 24 hours, and 402 ml of water was added to the cell per 24 hours to maintain a constant fill level. The volume consumed by Faraday losses is calculated to be 403 ml. Thus, the evaporative and Faraday losses equaled the maintenance water volume to within 1%.

Their water add back rates were consistent with the cell being close to 100% Faraday efficient, which implies that NASA's results were not due to recombination. In fact, according to the NASA scientists: "Our sparse water addition data thus seems not to entirely favor the recombination explanation."<sup>50</sup>

Since the Thermacore tests, Applicant has analyzed the electrolyte and has confirmed that novel hydride compounds were produced. The excess heat is corroborated by the isolation of novel inorganic hydride compounds such as

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<sup>50</sup> Reference 58.

$KHKHCO_3$  and  $KH$  following each of the electrolysis and plasma electrolysis of a  $K_2CO_3$  electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on  $KHKHCO_3$  which showed inorganic hydride clusters  $K[KHKHCO_3]^+$  and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii) proton nuclear magnetic resonance spectroscopy which showed upfield-shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions.<sup>51</sup>

Recently, Applicant has performed high-resolution visible spectroscopy on plasma electrolysis cells. Further confirmation is given by the high-resolution visible spectroscopic observation from rt-plasmas and plasma electrolysis cells of the predicted  $H^-(1/2)$  ion of hydrogen catalysis by each of  $K^+ / K^+$ ,  $Rb^+$ ,  $Cs$ , and  $Ar^+$  at 407 nm corresponding to its predicted binding energy of 3.05 eV.<sup>52</sup>

Independent tests were performed at Westinghouse Corporation that are given in a report: Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994. In this report, Westinghouse Electric Corporation reports that excess heat was observed during the electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) where the electrolysis of aqueous sodium carbonate served as the control. The data of the temperature of the cell minus the ambient temperature shows that when potassium carbonate replaced sodium carbonate in the same cell with the same input electrolysis power, the potassium experiment was twice as hot as the sodium carbonate experiment for the duration of the experiment, one month. The net faraday efficiency of gas evolution was experimentally measured to be unity by weighing the experiment to

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<sup>51</sup> References 8, 11, 41, 43 and 44.

<sup>52</sup> References 2, 7, 10, 11, 17, 22, and 25.

determine that the expected rate of water consumption was observed. The output power exceeded the total input power.

The reason for the uncertainty in the comparison of the potassium (catalyst run) with the sodium (control run) was that the potassium cell temperature was so high that a large unaccounted for amount of heat was lost due to evaporation. The skepticism on the part of STC experts regarded whether a 55 eV peak observed in the low binding energy region of the XPS spectrum of the high purity nickel cathode was a predicted hydride peak or whether the peak was due to iron. The survey scan, which was not given to the STC experts until a later date, showed no iron peaks. And, it was later confirmed by ToF-SIMS that iron could not be the source of the novel peak observed.<sup>53</sup>

Since these tests were performed, Applicant has amassed overwhelming evidence of lower-energy hydrogen as summarized in this Response.

Regarding the Weismann study referred to by the Committee, it reports that calorimetry of continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single-cell dewar calorimetry cell by Noninski at Brookhaven National Laboratory.<sup>54</sup> Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using a resistor, even though the power dissipated is equal in both cases. According to Applicant's theory, this apparent 'excess power' is due to the fact that the electron in a hydrogen atom can 'decay' to stable subinteger quantum levels. **Dr. Noninski demonstrated this thermal effect at BNL.**" The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

Wiesmann was cautious because he did not conduct the experiment himself; although, it was conducted in his laboratory at BNL. The results of the

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<sup>53</sup> Reference 82.

<sup>54</sup> Reference 83.

same experiment were published.<sup>55</sup> Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys<sup>56</sup> as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ( $\approx 50\text{ }^{\circ}\text{C} / W$  versus  $\approx 30\text{ }^{\circ}\text{C} / W$ ), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

For these reasons, the Committee should reconsider its unreasonable refusal to give proper weight to Applicant's calorimetric data.

**Applicant's response to the Committee's contention that "22. Accurate calorimetric experiment disproves applicant's thesis that apparent excess heat requires an explanation in terms of the postulated 'hydrino atom'"**

The Committee's reliance on a supposed "significant experiment" described by Shkedi et al. as a basis for dismissing Applicant's experimental observations of excess heat is totally misplaced.

It is not surprising that some researchers may make mistakes in attempting to perform any arbitrary experiment, including that of Applicant's. The cited experiment was not an identical copy of Applicant's experiment. Shkedi et al. did not fully follow Applicant's procedure. For example, Applicant discloses in Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994):

As usual in electrochemistry, measures were taken to avoid impurities in the system, especially organic substances. We note here the known problems with the reproducibility of the hydrogen overpotential which can be overcome only by ensuring the lowest possible level of impurities. The following procedures were applied

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<sup>55</sup> Reference 59.

<sup>56</sup> Reference 48.

in order to reproduce the excess heat effect. Before starting the experiment, the electrolysis dewar was cleaned with Alconox and 0.1 M nitric acid and rinsed thoroughly with distilled water to remove all organic contaminants. The Pt anode was mechanically scoured with steel wool, soaked overnight in concentrated  $\text{HNO}_3$ , and rinsed with distilled water. The nickel cathode was removed from its container with rubber gloves, and cut and folded in such a way that no organic substances were transferred to the nickel surface. The nickel cathode was dipped into the working solution under electrolysis current and never left in the working solution without electrolysis current.

Shkedi et al. did not follow this procedure. In fact, they did exactly that which was advised against. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in  $\text{Ni} - \text{H}_2\text{O}$  electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

The nickel coil assembly was cleaned by soaking it in acetone and methanol and was sintered at  $1000^\circ\text{C}$  for 2 hrs in an atmosphere of 95% argon/ $\text{H}_2$  at atmospheric pressure.

They also used different materials than those taught by Applicant. Applicant has found that sintered mesh type materials form a gas boundary layer that prevents the potassium ion catalyst which is in the electrolyte from contacting hydrogen atoms on the surface of the electrode. From Z. Shkedi, et al., "Calorimetry, excess heat, and Faraday efficiency in  $\text{Ni} - \text{H}_2\text{O}$  electrolytic cells", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1720-1731 (page 1722, 1st column):

Type B cathodes were made of Fibrex sintered nickel mesh (National Standard, 80% fiber/20% powder) rolled in two layers around the same nickel mandrel as in type A cathodes and secured with two turns of 1-mm nickel wire. Type B cathodes were not cleaned or sintered after assembly.

The Committee states that the observation of recombination by Shkedi et al. implies that Faraday inefficiency may explain excess heat observed by NASA and others. It is important to keep in mind, however, that the cell design of

Shkedi et al. was very different from that of NASA and Thermacore. It favored recombination and was in fact designed to recombine all of the gases as a closed calorimeter when operating in that mode. Even so, Tables I-IV of Shkedi et al. show a range of Faraday efficiencies from 73% to 99%. Whereas, 0% Faraday efficiency was required in order to explain away the NASA results. The Committee offers no other plausible explanation for the 11 W of excess power observed by NASA.

In cases where Applicant was an advisor, Applicant has a 100% track record of independent laboratories reporting an effect. Many of the results of these laboratories could not be attributed to recombination since the observed power was greater than the total input such as:

**Mills, R., Good, W., "Fractional Quantum Energy Levels of Hydrogen", Fusion Technology, Vol. 28, No. 4, November, (1995), pp. 1697-1719.**

Excess power and heat were observed during the electrolysis of aqueous potassium carbonate. Flow calorimetry of pulsed current electrolysis of aqueous potassium carbonate at a nickel cathode was performed in a single-cell dewar. The average power out of 24.6 watts exceeded the average input power (voltage times current) of 4.73 watts by a factor greater than 5. The total input energy (integration of voltage times current) over the entire duration of the experiment was 5.72 MJ; whereas, the total output energy was 29.8 MJ. No excess heat was observed when the electrolyte was changed from potassium carbonate to sodium carbonate.

**Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994).**

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed by Thermacore, Inc. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions.

The pH, specific gravity, concentration of  $K_2CO_3$ , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by HydroCatalysis Power Corporation. Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

**R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991).**

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate ( $K^+/K^+$  electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by Mills of Franklin and Marshall College and Kneizys of Ursinus College. Excess power out exceeded the input power by a factor greater than 37. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate.

**Jacox, M. G., Watts, K. D., "The Search for Excess Heat in the Mills Electrolytic Cell", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, January 7, 1993.**

Idaho National Engineering Laboratory (INEL) operated a cell identical to that of Thermacore<sup>57</sup> except that it was minus the central cathode and that the cell was wrapped in a one-inch layer of urethane foam insulation about the cylindrical surface. The cell

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<sup>57</sup> Reference 47.

was operated in a pulsed power mode. A current of 10 amperes was passed through the cell for 0.2 seconds followed by 0.8 seconds of zero current for the current cycle. The cell voltage was about 2.4 volts, for an average input power of 4.8 W. The electrolysis power average was 1.84 W, and the stirrer power was measured to be 0.3 W. Thus, the total average net input power was 2.14 W. The cell was operated at various resistance heater settings, and the temperature difference between the cell and the ambient as well as the heater power were measured. The results of the excess power as a function of cell temperature with the cell operating in the pulsed power mode at 1 Hz with a cell voltage of 2.4 volts, a peak current of 10 amperes, and a duty cycle of 20 % showed that the excess power is temperature dependent for pulsed power operation, and the maximum excess power was 18 W for an input electrolysis joule heating power of 2.14 W. Thus, the ratio of excess power to input electrolysis joule heating power was 850 %. INEL scientists constructed an electrolytic cell comprising a nickel cathode, a platinized titanium anode, and a 0.57 M  $K_2CO_3$  electrolyte. The cell design appears in Appendix 1. The cell was operated in the environmental chamber in the INEL Battery Test Laboratory at constant current, and the heat was removed by forced air convection in two cases. In the first case, the air was circulated by the environmental chamber circulatory system alone. In the second case, an additional forced air fan was directed onto the cell. The cell was equipped with a water condenser, and the water addition to the cell due to electrolysis losses was measured. The data of the forced convection heat loss calorimetry experiments during the electrolysis of a 0.57 M  $K_2CO_3$  electrolyte with the INEL cell showed that 13 W of excess power was produced. This excess power could not be attributed to recombination of the hydrogen and oxygen as indicated by the equivalence of the calculated and measured water balance.

**Nesterov, S. B., Kryukov, A. P., Moscow Power Engineering Institute Affidavit, February, 26, 1993.**

The Moscow Power Engineering Institute experiments showed 0.75 watts of heat output with only 0.3 watts of total power input (power = VI) during the electrolysis of an aqueous potassium carbonate electrolyte with a nickel foil cathode and a platinized titanium anode. Excess power over the total input on the order of 0.45 watts was produced reliably and continuously over a period of three months. Evaluation of the electrolyte after three months of operation showed no significant change in its density or molar



concentration. The cell was disassembled and inspected after over one month of operation at 0.1 amperes. This inspection showed no visible signs of a reaction between the electrodes and the electrolyte. The cell was re-assembled and operated as before. Excess energy was produced for the three-month duration of the experiment. Scintillation counter measurements showed no signs of radiation external to the cell.

**Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995.**

During the electrolysis of aqueous potassium carbonate, researchers working at MIT Lincoln Laboratories observed long duration excess power of 1-5 watts with output/input ratios over 10 in some cases with respect to the cell input power reduced by the enthalpy of the generated gas. In these cases, the output was 1.5 to 4 times the integrated volt-ampere power input. Faraday efficiency was measured volumetrically by direct water displacement.

Excess heat was also observed in a closed cell:

**Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.; "Calorimetry for a Ni/K<sub>2</sub>CO<sub>3</sub> Cell", Atomic Energy Canada Limited, Chemical Engineering Branch, Chalk River Laboratories, Chalk River, Ontario, June 1994.**

Atomic Energy Canada Limited, Chalk River Laboratories, report that 128 % and 138% excess heat were observed in separate experiments by flow calorimetry during the electrolysis of aqueous potassium carbonate (K<sup>+</sup>/K<sup>+</sup> electrocatalytic couple) in a closed cell, and that 138% was observed in an open cell.

Since these electrolysis experiments, Applicant has advanced to plasma cells, which produce a power density as high as 1000 times that achieved in the electrolysis cells. In this case, the calorimetry is trivial. A summary of equivocal measurement of power is disclosed elsewhere in this Response. Line broadening, electron temperature, high energy spectroscopic lines corresponding to lower-energy hydrogen species and the analysis and characterization of the novel hydrogen products confirm the calorimetry as given in this Response. In

addition, a plasma was observed when all power has been removed from the cell that lasted for a time that was 1000 times the typical plasma decay time which proves a new energy source.<sup>58</sup>

The time has come for the Committee to acknowledge this vast body of experimental evidence, including Applicant's calorimetric data, and allow the subject application to issue as a patent.

**Applicant's response to the Committee's contention that "23. The Phillips Declaration with respect to 'hydrino' formation in a calorimeter lacks probative value"**

The Committee's criticism of the Phillips Declaration based on a document from EarthTech, Inc., Applicant's competitor, is completely unfounded.

Phillips' results are given in a report:

**Phillips, J., Smith, J., Kurtz, S., "Report On Calorimetric Investigations Of Gas-Phase Catalyzed Hydrino Formation" Final report for Period October-December 1996", January 1, 1997, A Confidential Report submitted to BlackLight Power, Inc. provided by BlackLight Power, Inc., -Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills' hydrino formation hypothesis. In three separate trials, between 10 and 20 K Joules were generated at a rate of 0.5 Watts, upon admission of approximately  $10^{-3}$  moles of hydrogen to the 20  $cm^3$  Calvet cell containing a heated platinum filament and  $KNO_3$  powder. This is equivalent to the generation of  $10^7 J/mole$  of hydrogen, as compared to  $2.5 \times 10^5 J/mole$  of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be 100 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills' model.

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<sup>58</sup> Reference 1, 36, and 37.

The Committee improperly dismisses the Phillips data by misinterpreting the referenced EarthTech document. First of all, Earth Tech is a competitor that Applicant believes is adversarial. It is therefore possible that they have provided misinformation.

Furthermore, Applicant was unaware of the incorrect specifications sourced to EarthTech by the Committee. However, on inspection of the document: "EarthTech's campaign to replicate one of the BlackLight Power excess heat results", on page 3, of the "BLP gas phase replication effort-Run 13" Applicant reads "**our** [emphasis added] detection limit for excess should be put at about 1 or 2 watts." Thus, it appears that the Committee carelessly erred in applying the specifications of EarthTech's instrument to the interpretation of Phillips' data.

Dr. Phillips' expert technical capability is established in his Declaration. Clearly, a person of his stature and knowledge would not make statements beyond the capability of the instrument. In fact, Phillips has published several peer-reviewed papers using this calorimeter. For example, a description of the calorimeter is in Dr. Phillips's paper entitled, "High-temperature Calvet-type calorimeter for Investigating water reactions", Review of Scientific Instruments, Vol. 66 (1), January, 1995. In this paper the calorimeter is calibrated, see Figure 4, and the calorimeter demonstrated the ability to measure tenths of joules.

In Dr. Phillips' affidavit, the energy measured from BLP materials was stated as 31,000 joules. The energy reported in the affidavit is greater than 100 times the signal to noise for the instrument. In addition, the January 1996 report contains two finger tests that were performed prior to experimentation, see figures 21-1 and 22-1. These finger tests clearly demonstrate the signal to noise characteristics of the instrument. In the same report the energy balance is stated to hundredths of joules for the experiments, providing further guidance to the sensitivity of the instrument.

Thus, the Committee's rejection of the Declaration from Dr. Phillips, who is a Distinguished National Laboratory Professor at the University of New Mexico, Department of Chemical and Nuclear Engineering, and a scientist at Los Alamos

National Laboratory, based on improper information from a third-party competitor or a careless error is shown to be erroneous.

The Committee should also be made aware that EarthTech promotes "infinite energy from vacuum" which Applicant finds incredulous. Further, Applicant was contacted by Scott Little of EarthTech under the following pretext:

**Scott Little Email of 3/2/99:**

Although it would appear that you have sufficient funding and business structure in place, we are in a position to bring to the table essentially unlimited financial resources from a private investor with excellent connections in the international community. We consider this one of our most valuable resources with regard to a smooth transition to a new energy economy.

Scott R. Little  
Harold E. Puthoff

Puthoff is a promoter of "infinite energy from the vacuum," which he claims can be used for power generation, space propulsion, as well as explain the stability of the hydrogen atom. He is also the President/CEO of EarthTech International, Inc. The following is a sampling of his publications:

Puthoff, H.E., "THE ENERGETIC VACUUM: IMPLICATIONS FOR ENERGY RESEARCH" *Speculations in Science and Technology*, vol. 13, no. 4, pp. 247-257, 1990.

Puthoff, H.E., "Gravity as a Zero-Point-Fluctuation Force", *Physical Review A*, vol. 39, no. 5, pp. 2333-2342, 1 March 1989.

Puthoff, H.E., "Source of Vacuum Electromagnetic Zero-Point Energy," *Physical Review A*, vol. 40, no. 9, pp. 4857-4862, 1 November 1989.

Puthoff, H.E., *Review A*, vol. 44, no. 5, page 3382 and 3385-3386, and an Erratum in *Physical Review A*, vol. 41, no. 5, page 2902.

Puthoff, H.E., "Everything for Nothing", *New Scientist*, pp. 52-55, 28 July 1990.

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See also, Interview with possible Roswell witness on 07 January 1993 by H.E. Puthoff, Institute of Advanced Studies, Austin, TX  
<http://www.ufomind.com/misc/1997/jul/d26-001.shtml>

Finally, the Committee's reference to the lack of success with the water bath calorimeter is indeed positive evidence of the catalysis mechanism. The catalysts condensed on the cold walls and was not operative according to Applicant's expectations. This explanation was also offered by Dr. Phillips.

In addition to Applicant's calorimetric data, Applicant has now conclusively shown experimentally that the disclosed lower-energy hydrogen exists with the same spectroscopy upon which quantum mechanics was initially based in its infancy before its deviation from the physical world into other imaged dimensions and virtual particles. Applicant's spectroscopic data must be treated with the same respect and judged by the same standards. In addition to spectroscopy, Applicant has confirmed these lower-energy states by an exhaustive array of other test data.

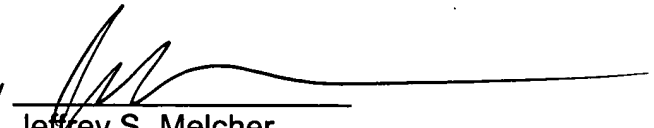
Applicant therefore calls on the Secret Committee to cease its unfair attacks on that data and allow the subject application to issue as a patent.

**Conclusion**

For the foregoing reasons, Applicant respectfully submits that the subject application fully satisfies the legal requirements of 35 U.S.C. §§ 101 and 112, first paragraph, and is therefore in condition for allowance. A Notice to that affect is earnestly solicited.

Respectfully submitted,  
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### **Test Reports**

Numerous test reports are available from BlackLight Power (e.g. Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995; Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994; Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.; "Calorimetry for a Ni/K<sub>2</sub>CO<sub>3</sub> Cell," Atomic Energy Canada Limited, Chemical Engineering Branch, Chalk River Laboratories, Chalk River, Ontario, June 1994; Nesterov, S. B.,

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### **Upcoming Conference Presentations**

1. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," Division of Fuel Chemistry, Session: Chemistry of Solid, Liquid, and Gaseous Fuels, 227th American Chemical Society National Meeting, March 28-April 1, 2004, Anaheim, CA.

### **Prior Conference Presentations**

50. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," (Division of Industrial and Engineering Chemistry Symposium), September 9, 2003, 226<sup>th</sup> American Chemical Society National Meeting, (Sept. 7-11, 2003), New York, NY.
49. B. Dhandapani, R. Mills, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas" (Physical Chemistry Session) , Wednesday, June 11, 2003,

- 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
48. P. Ray, R. Mills, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma" (Physical Chemistry Session) , Wednesday, June 11, 2003, 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
47. R. Mills, "Novel Catalytic Reaction Of Hydrogen as a Potential New Energy Source" (Catalysis Session), Tuesday, June 10, 2003, 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
46. J. He, R. Mills, "TOF-SIMS and XPS Studies of Highly Stable Silicon Hydride Films" (Inorganic/Solid State Session), Monday, June 9, 2003, 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
45. B. Dhandapani, R. Mills, "Low Power MPCVD Synthesis and Characterization of Diamond Films on Silicon Substrates" (Inorganic/Solid State Session) , Monday, June 9, 2003, 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
44. X. Chen, R. Mills, "Calorimetric Study of Heat Generation by Catalytic Reaction of Atomic Hydrogen in Resonant Transfer Plasmas" (Fuel Cells Session) , Monday, June 9, 2003, 36<sup>th</sup> Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
43. R. L. Mills, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source," Division of Industrial and Engineering Chemistry, "Green Chemistry in the Design of Alternative Energy Strategies," symposium, Oral Presentation, 225<sup>th</sup> ACS National Meeting, (March 23-27, 2003), New Orleans, LA.
42. R. L. Mills, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source," Monday, November 25, Room 216, Protocol Center, TA-3, Los Alamos National Laboratory.
41. R. L. Mills, "Classical Quantum Mechanics," Monday, November 25, Room 216, Protocol Center, TA-3, Los Alamos National Laboratory.

40. R. L. Mills, Seminar: "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source," US Environmental Protection Agency, National Risk Management Research Laboratory, Sustainable Technologies Division, Cincinnati, OH, October 24, 2002.
39. R. L. Mills, J. Dong, J. He, B. Dhandapani, A. Voigt, M. Nansteel, J. Sankar, R. M. Mayo, P. Ray, "Novel Catalytic Reaction of Hydrogen as a Potential New Energy Source," Division of Inorganic Chemistry, Oral Presentation, 224<sup>rd</sup> ACS National Meeting, (August 18-22, 2002), Boston, MA (Aug. 22, 4:10-4:30 PM).
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37. P. Ray, R. Mills, "Spectroscopic Characterization of Stationary Inverted Balmer and Lyman Populations Formed by a Catalytic Reaction of Atomic Hydrogen with Oxygen and with Certain Group I Catalysts," Eighteenth International Conference on Atomic Physics, July 28-August 2, 2002, Cambridge, Massachusetts.
36. R. M. Mayo, R. L. Mills, M. Nansteel, "Direct Plasmadynamic Conversion of Plasma Thermal Power from a Novel Plasma Source to Electricity for Microdistributed Power Applications," 40<sup>th</sup> Power Sources Conference, (June 6-13, 2002), Cherry Hill, NJ.
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29. R. Mills, "BlackLight Power Technology-A New Clean Energy Source with the Potential for Direct Conversion to Electricity," *The 8<sup>th</sup> Annual Emerald Groundhog Day Investment Forum*, February 5, 2002, Wyndham Franklin Plaza Hotel, Philadelphia, PA, Organized by Emerald Asset Management, Lancaster, PA.
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27. P. Ray, R. Mills, "Spectroscopic identification of a novel catalytic reaction of hydrogen plasma," Session ET1: Lighting, American Physical Society Meeting, 54th Annual Gaseous Electronics Conference, October 9–12, 2001, Pennsylvania State University, State College, PA.
26. R. Mills, "Novel catalytic reaction of hydrogen as a potential new energy source," Division of Industrial and Engineering Chemistry; Session: Industrial Bio-Based Technology, 222nd American Chemical Society Fall National Meeting, (August 26–30, 2001), Chicago, IL.
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15. R. Mills, J. He, and B. Dhandapani, "Novel Alkali and Alkaline Earth Hydrides," August National ACS Meeting (220th ACS National Meeting, Washington, DC, (August 20-24, 2000)).
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13. Mills, J. Dong, N. Greenig, and Y. Lu, "Observation of Extreme Ultraviolet Hydrogen Emission from Incandescently Heated Hydrogen Gas with Certain Catalysts," 219 th National ACS Meeting, San Francisco, California, (March 26-30, 2000).
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